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This operations manual has been prepared to assist EPA personnel establish and operate Remote Job Entry (RJE) minicomputers by providing standard operations and management guidelines.

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PM-218
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OPERATIONS

GUIDE TO EPA

REMOTE JOB ENTRY

MINICOMPUTERS

MAY 1977

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TABLE OF CONTENTS

I. INTRODUCTION 1

II. SAMPLE DAILY OPERATIONS 3

1. Prepare for Daily Processing 3
2. Process Daily Work 5
3. Correct Problems 7
4. End Daily Processing 9

III. MAINTENANCE AND BACKUP 10

1. Scheduled Vendor Hardware Maintenance . . . 11
2. Operator Maintenance 12
3. Software Maintenance and Backup 13
4. Supplies and Materials Ordering 14

IV. OPERATIONS DOCUMENTS 15

1. Minicomputer Schedule and Notice Board . . . 15
2. Daily Schedule 16
3. Run Book 19
4. Job Service Card 22
5. Operations Log 22
6. Engineering Log 24
7. Tape and Disk Labels 24
8. Software Maintenance Log 27

V. ROOM ENVIRONMENT 29

1. G.S.A. Requirements 29
2. General Housekeepings Considerations 30

VI. COMMUNICATIONS 32

1. RJE To IBM 32
2. RJE To UNIVAC 33
3. Local Terminals 33
4. Remote Terminals 33

APPENDIX A IAS DOCUMENTATION DIRECTORY

APPENDIX B SAMPLE DOCUMENTS

APPENDIX C PDP-11 GLOSSARY

I. INTRODUCTION

This operations manual has been prepared to assist EPA personnel establish and operate Remote Job Entry (RJE) minicomputers by providing standard operations and management guidelines. The installation of minicomputers will expand the set of operating responsibilities required from local ADP personnel. As a result, new procedures will be needed to manage effectively the minicomputer operations.

The information contained in this manual is structured so that ADP personnel may reference each chapter independently. The remainder of this manual is organized into five chapters, as follows:

- Sample Daily Operations
- Maintenance and Back-up
- Operations Documents
- Room Environment
- Communications

This manual should be used in conjunction with available DEC publications. A synopsis of these documents is presented in Appendix A of this manual. Appendix B contains a set of sample forms that are exhibited also in the body of this manual. Appendix C contains a useful glossary of terms associated with the PDP minicomputer.

This manual assumes some revisions in current ADP titles and responsibilities. In most cases, the ADP branch chief or other ADP management person should designate a system manager to maintain the operating system, allocate machine resources as directed by the manager, and educate users in understanding operating system capabilities. The manager also must designate minicomputer operations personnel to operate the minicomputer, to schedule and control work flows and to perform routine maintenance and to perform system backups.

Comments or suggestions concerning this manual should be

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As necessary, revisions to this manual will be distributed to the appropriate ADP personnel.

II. SAMPLE DAILY OPERATIONS

This chapter presents the computer room operator's daily procedures at a typical RJE minicomputer. These procedures consist of four major activities, as follows:

- Prepare for daily processing
- Process daily work
- Correct problems
- End daily processing

These activities represent an increased level of effort compared to the activities associated with operating Headquarters or regional RJE or low-speed terminals.

1. PREPARE FOR DAILY PROCESSING

This section presents the procedures to be followed by the RJE minicomputer operator in preparing for processing programmer and user jobs. Preparation for daily processing consists of four functions, as follows:

- Machine startup
- Output dispatching
- Minicomputer scheduling
- Daily maintenance

Occasionally, the manager requires variations in the preparation routine, such as de-activating a peripheral device for unscheduled maintenance. When this occurs, the manager should document these variations in the Daily Schedule (Chapter IV). The minicomputer operator should check the Daily Schedule before undertaking any preparation activities.

(1) Machine Startup

The operator should not turn the PDP 11 on and off. Instead, the minicomputer should be left running. Initial startup of a cold machine causes temperature changes that may damage the electronic components of the computer. Over time, these changes reduce the working life of computer components.

If the machines has been shutdown, six steps should be taken to "cold start" the machine, as follows:

- Check all obvious electrical connections and power cables. If peripheral devices

such as terminals and teletypes have been moved electrical connections may have been broken.

- If the air conditioning system has been disabled, activate the air conditioning equipment. Wait until the room temperature is within the vendor-specified operating range before proceeding with the next step. For PDP 11 configurations, the operating range is 65° F to 80° F. The computer will run outside these limits, but this practice is not recommended.

- Activate main frame power by turning the KEY SWITCH to the POWER position (not the LOCK position).

- Power up all peripheral devices. Insure that all devices are on before proceeding with the next step.

- Mount all appropriate system disks and tapes. System disks and tapes contain all operating system and public libraries.

- Bootstrap the IAS/RSX operating system from the computer console according to instructions in the DEC IAS System Management Guide (Chap. 5.2).

After these steps have been taken, the computer should be ready for the input and processing of all jobs. If not, the operator should check for obvious problems indicated by console messages or device not ready indicators and then notify the system manager. The system manager should check for IAS software problems and make any necessary patches (documented by DEC IAS software releases). If this procedure fails to start processing then DIGITAL Field Service should be consulted.

(2) Output Dispatching

Output dispatching is the distribution of computer output to programmers and users. All output generated from the previous night or left over from the last shift should be distributed into appropriate programmer and user locations. The room should have an output distribution area where users have designated output bins or shelves.

If a job required the use of special disks or tapes, these should be returned to the disk and tape library. The operator should insure that each returned disk and tape is properly labeled according to procedures discussed in Chapter IV.

(3) Computer Scheduling

Computer Scheduling is the updating of the Computer Schedule Board (Chapter IV) to reflect the current day's schedule of computer resources. The Computer Schedule Board informs users of the times at which the computer is available. The operator should update the Computer Schedule Board according to instructions in the Daily Schedule (Chapter IV). For example, the Computer Schedule Board normally might state that all remote jobs and local batch jobs will be processed between 9:00 A.M. and 3:00 P.M., and that on-line systems development will be allowed only between 3:00 P.M. and 6:00 P.M. The operator should make appropriate changes on the Computer Schedule Board if any variations from the normal schedule are needed such as to allow vendor maintenance of equipment.

(4) Daily Maintenance

The operator is responsible for performing routine daily maintenance such as tape head cleaning and stocking supplies necessary for the day's processing. These responsibilities are discussed in Chapter III. Daily maintenance should be performed at the start of the day to insure that the computer and peripheral devices are in the best possible condition for daily processing.

2. PROCESS DAILY WORK

This section outlines the input, servicing and monitoring of routine jobs. This processing consists of four categories, as follows:

- Job entry
- Use of the Run Book
- Use of the Operations Log
- Job service

(1) Job Entry

Jobs may be entered into the PDP 11 either in batch mode or through on-line terminals. For batch entry

of jobs, a user should submit his job to the operator at a designated job submittal area. If a job requires any special servicing not documented in the Run Book, this should be fully documented on the Job Service Card (Chapter IV). (The Run Book is a collection of operator job servicing instructions.) The operator should attach the Job Service Card to the appropriate page in the Run Book.

Upon receiving a job, the operator should place a standard job card with the input. The job should then be entered into the machine. A copy of the job card should be given to the user as a receipt for job input. All job cards should be generated in duplicate for this purpose.

For the on-line entry of jobs, users queue up their own jobs from remote terminals. The operator has no involvement with the input of these jobs. If any on-line entered job requires special servicing by the operator outside of instructions in the Run Book, the user who enters the job is responsible for submitting a Job Service Card to the operator before initiating the job.

(2) Use of the Run Book

The Run Book is a collection of instructions listed by program that explain what the operator should do whenever programs require special servicing, such as the mounting of a tape or a disk. Whenever a programmer or user requires the operator to perform any function other than routine job input and dispatching of output, the required functions must be documented in the Run Book. Examples of instructions for programs and further explanation of the Run Book are discussed in Chapter IV of this document.

All jobs that require servicing should have documentation in the Run Book or on a Job Service Card. This eliminates the need for an operator to try to guess what action he should take in response to a job-generated request for servicing. If a program requires special servicing and the programmer or user has not turned in documentation for the Run Book or a Job Service Card, the job should not be run. If the job has started, the job should be terminated by the operator and the reason recorded in the Operations Log. (The Operations Log is a record of job processing.) The operator should indicate on the Job Service Card the reason for job termination.

(3) Use of the Operations Log

The Operations Log is a journal that records the day's processing and the operator's activities. The log contains a listing of batch jobs entered, operating system or job-generated messages to the operator and operator response to these messages. Most of the log consists of computer-generated messages from the operator's console. The remainder consists of operator typed system responses and manual comment entries on the console.

System response entries are typed in by the operator and "heard" by the computer. An example might be an operator typing in a command that terminates a job or which informs a job that a requested tape has been mounted on tape drive #2. Manual comments are comments of any sort not heard by the system. An example might be an explanation of why a job was terminated or a message noting the time of a system or hardware failure. The system Manager should be able to reference the log and obtain a clear picture of each day's processing activities.

(4) Job Service

Job service concerns the operator's response to data center user requests, such as tape mounting or special forms loading. Such requests appear on the operator console. An example might be the message "EPA4... Please mount the January accounting tape." The operator should mount the tape and respond to the message according to the instructions for program EPA4 in the Run Book.

3. CORRECT PROBLEMS

The operator is responsible for ascertaining processing problems and aiding in recovery operations. There are five categories of systems failures and recovery procedures that arise at a minicomputer data center, as follows:

- Processing halts because of devices not ready
- Applications software failures
- Systems software failures
- Hardware failures
- Recovery

When a problem develops the operator should determine the category of the problem and follow the prescribed procedure. If the operator cannot determine the type of problem, he should notify his supervisor.

(1) Processing Halts Because of Devices Not Ready

These processing halts occur when the computer has attempted to access a peripheral device and failed. The operator is made aware of this condition by a "DEVICE NOT READY" message on the console or by a telephone call from an on-line user. The cause of the condition may be a line printer out of paper, an unmounted disk or tape, or the device not switched on-line prior to processing. The cause will be readily apparent to the operator, who should take appropriate action to bring the device on-line. If the operator cannot determine the cause or the error he should notify his supervisor.

(2) Applications Software Failure

Applications software failure is the failure of a user job caused by programming errors. The failure is detected by the IAS/RSX operating system which terminates the job and makes a notation of this action on the operator console.

Occasionally, an operator might notice that a normal production job has been running far longer than normal or that meaningless output is being printed. In such circumstances, an experienced operator will terminate the jobs and make an entry into the Operations Log. This type of response is only recommended for experienced operators acting with the approval of the manager.

After a system or operator-generated job termination, the operator should dismount any tapes, disks or special tapes required for the job.

(3) Systems Software Failure

A systems software failure is the failure of the IAS/RSX operating system itself. Evidence of such failures is the computer's lack of response to console inquiries. The operator should notify the systems staff of the problem and solicit their recommendations for recovery. If the system fails repeatedly, the operator should notify DIGITAL Field Service. All events should be noted in the Operations Log and a notice should be posted on the Computer Schedule Board.

(4) Hardware Failure

Hardware failure is the failure of the computer hardware. This failure is indicated by a message on the console or by a total halt in processing similar to that caused by an operating system failure. A visual inspection of the equipment should be made to see if there are any obvious causes such as damaged equipment or disconnected electrical cable. If this inspection fails to reveal any obvious correctable problems, the operator should call DIGITAL Field Service, note the problem in the Operations Log and post a notice on the Computer Schedule Board.

(5) Recovery

Once any problems such as severe system crashes or hardware failures have been resolved, the systems staff should determine the type of recovery necessary. Recovery procedures can range from simply restarting the IAS/RSX operating system to the reloading of the entire operating and applications systems from back-up tapes. The operator is responsible only for following the recovery procedures prescribed by the systems staff. However, the operator is responsible for informing users of the extent of the failure and of the type of recovery measures that were implemented. Users of on-line file update systems are responsible for regenerating their respective data bases through applications systems recovery procedures.

4. END DAILY PROCESSING

This section discusses the procedures to be followed by the computer operator in ending a day's processing. Ending daily processing consists of three major functions, as follows:

- Backup and storage
- Output dispatch
- Machine shutdown

Occasionally, the manager will require variations in this normal routine. He should document these variations in the Daily Schedule (Chapter VI). The computer operator should check the Daily Schedule before closing down.

(1) Backup and Storage

All system and public disks should be backed up to tape once each day. The backup procedure is described in detail in Chapter V of this manual. The backup tapes and disk should be placed in a safe location to insure availability in case they are needed. Private disks should be backed up also according to the job procedures specified for the application. Disk files that have been updated on-line or through batch programs should be copied to tape.

(2) Dispatching

User output should be distributed to designated locations. Tapes and disks should be returned to the tape library. The operator must insure that all tapes and disks are properly labeled to reflect their updated status.

(3) Machine Shut Down

As explained earlier, the PDP 11 should not be shutdown on a daily basis. Shutdowns should be authorized only by the manager. When necessary, the following procedure should be used.

- Insure that all jobs are done and that no more output remains.
- Disable the IAS operating systems by running the SHUTDOWN program from the console. (Refer to IAS System Management Guide)
- Upon completion of the SHUTDOWN program, turn off and power down all peripheral devices. Be sure to store all disks and tapes properly.
- Turn the KEY SWITCH on the PDP 11 to the POWER OFF position.
- If instructed by the supervisor, turn off the air conditioning. The air conditioning must not be turned off if there are any other computers remaining operative in the computer center.

After these steps are taken, all computer related devices should be completely inactive.

III. MAINTENANCE AND BACKUP

Proper maintenance and backup are necessary for any computer regardless of size. Although minicomputers are less prone to CPU equipment failure than large computers, it is still advisable to perform periodic maintenance. Maintenance and backup consists of four major categories, as follows:

- Scheduled vendor hardware maintenance
- Operator maintenance
- Software maintenance and backup
- Supplies and material ordering

Proper maintenance of hardware avoids costly machine downtime and component replacement. The operator should be aware that even small maintenance oversights can lead to expensive repair jobs.

Software backup avoids costly reprogramming and regeneration of data files in the event of a severe systems crash or data center disaster.

Supplies and material ordering should be viewed as maintenance of the computer supply stocks.

1. SCHEDULED VENDOR HARDWARE MAINTENANCE

As part of the DIGITAL Service Plan, a field service representative performs standard maintenance on the PDP 11 once a month. The representative is responsible for machine and peripheral maintenance, and for logic testing the PDP 11 for any internal hardware failures. The representative cleans and lubricates tape drives, disks, card readers, and other electro-mechanical devices. He replaces all worn parts and exchanges air filters for tape and disk drives, as necessary. The operator should become familiar with the maintenance procedure to confirm that all tasks have been completed by the field representative. Under no circumstances should personnel attempt any hardware maintenance performed by the DIGITAL field service representative since this might void the DIGITAL warranty on the computer and peripherals. The operator should consult with the field service representative about daily maintenance procedures.

Those peripherals that are not manufactured by or purchased from DIGITAL usually have scheduled maintenance performed by their manufacturer's representatives. If not, the operator is responsible for the regular maintenance of the equipment and should familiarize himself with correct procedures. In all cases, the operator should insure that

proper maintenance is performed on a regular basis.

The operator should inform all programmers and users five working days in advance of any scheduled maintenance that requires machine shutdown. This should be done by posting notices on the Computer Schedule Board.

2. OPERATOR MAINTENANCE

Operator maintenance involves the care and servicing of those devices that have electro-mechanical components. The most critical of these devices that require operator servicing are disk drives, printers and card reader/punches.

(1) Daily Maintenance

The operator should develop a daily routine for maintaining and servicing his equipment. He should prepare and use a simple maintenance checklist and make notations as necessary. A checklist should include the following instructions.

- Visually inspect the computer and peripherals for signs of obvious defects.
- Examine all major cables, and electrical connections.
- Clean the exterior of all equipment according to manufacturer's instructions.
- Remove any unnecessary objects from the computer room, especially if they have been placed on the equipment.
- Check all printing devices and replace ribbons and paper as necessary.
- Check the condition of tape drives and clean components each day.
- Check temperature and humidity indicators to insure that the temperature and humidity are within computer operating limits (65° to 80°F, 40% to 60%). If they are not, notify the supervisor.

The operator should add any other instructions or comments that he feels are necessary.

(2) Tape and Disk Drives

The tape and disk drives require maximum operator care

because of their sensitivity to dirt. The tape drive unit should be cleaned each day. The operator should pay particular attention to drive capstans, pulleys, vacuum columns, and read/write heads.

The glass disk drive cover and the disk pack cover should be kept free of dust and debris. The cover for the disk pack should be stored on top of the glass disk drive cover. The disk drive cover should never be opened while the disk is still spinning. Under no circumstances should a disk pack that has been dropped be mounted on a drive until it has been checked by a DIGITAL field service representative.

3. SOFTWARE MAINTENANCE AND BACKUP

Operator responsibility for software maintenance is limited normally to backup of system data files.

(1) Application Systems

Operators should backup all application systems and their corresponding data files as instructed by the applications manager. It should be made clear to all applications managers that the operator is not responsible for backup of applications systems unless explicitly instructed by the applications manager. These backups should be performed from disk to tape. The IAS operating system includes standard backup utilities for this purpose. At the time of the backup no users should be on the system. Each backup tape should be retained for at least one week. Once a month, or more often if necessary, a set of system backup tapes should be removed from the room and stored at a remote location. This provides backup security in case of a building fire or other major disaster. The operator should urge programmers and other systems developers to create and store in a remote location backup tapes for their individual projects.

(2) Operating Systems

Current versions of the IAS operating systems including all recent patches should be backed up to tape and stored in a remote location. Copies also should be readily available in case of severe systems crashes.

(3) New Releases

New releases, patches or updates to software products or the IAS operating system should be installed by a field service representative. Information regarding new releases should be referred to the data center manager. Installation of a new software product or

operating system release should be noted on the Computer Schedule Board at least five working days in advance of its installation.

4. SUPPLIES AND MATERIAL ORDERING

The operator is responsible for insuring that there are adequate stocks of data center supplies and materials. Materials must be ordered with enough lead time to allow for processing and shipping. Materials specific to particular applications projects are the responsibility of the applications manager.

All materials except those necessary for daily processing should be stored in a separate supply room. An inventory list should be made for these supplies allowing space for special supplies that might not be present routinely. The computer operator should take inventory once every two weeks and have those materials ordered that have been depleted past their re-order points. The inventory should include materials specific to applications systems if these materials are stored in the supply room. Care should be taken in filling out order forms to insure accuracy. Upon arrival of ordered material, the operator should check the order to insure that the material is undamaged. Any material that is damaged or not the same as ordered should not be accepted for delivery.

IV. OPERATIONS DOCUMENTS

Operations documents are the schedules, logs and forms that aid in maintaining a smooth workflow through the minicomputer. These documents are used to standardize and control diverse types of data processing requirements. When problems or questions develop, the documents provide a base for an accurate resolution of these matters.

Failure to maintain accurate operations documents can lead to a variety of crises, including:

- Non-processing of a submitted job
- Failure to receive or locate a user job
- Mounting of the wrong tape
- Machine unavailable when needed
- Cancellation of job
- Confusion regarding processing responsibility

The following eight documents, boards, and forms should be developed and maintained:

- Computer schedule and notice board
- Daily schedule
- Run book
- Job service card
- Operations log
- Engineering log
- Tape and disk labels
- Software maintenance log

If any additional needs arise, the manager may expand this list, as necessary. These documents should be as short and concise as possible yet still provide needed management and control information.

1. COMPUTER SCHEDULE AND NOTICE BOARD

The Computer Schedule and Notice Board is a large board

that indicates computer availability and type of usage for the upcoming week. The board should serve also as a message center for formal communications between the operations and systems development staff. Exhibit 4-1, on the following page, is an example of a computer schedule and notice board layout. Exhibit 4-2, on the page following Exhibit 4-1, is an example of a completed Computer Schedule and Notice Board. Each day the operator should update the board to reflect daily schedules for each of the next seven days.

The operator should update the schedule as soon as events that affect the schedule occur. For example, after an operating system crash occurs, the operator should post a "systems down" message and an estimated time when the system will be available again.

Keeping the data processing users well informed via the board greatly aids user planning. If a programmer knows that the system is down for the day, he can address his energies to those functions that do not require use of the computer. Many times programmers have waited for 30 minutes or more only to find that the system is down for the day. Timely posting of information via the computer schedule board avoids this wasted effort. If possible, the operator should post the reason for the crash, such as disk failures or parity error. Systems development people find it especially helpful to know the symptoms and reasons behind any crashes since such failures may affect development efforts which are not apparent to the operator. Posting this type of information on the board also keeps the operator from having to answer repeated questions from programmers. Consequently, he can spend more time resolving the problems at hand.

The notice section of the Computer Schedule and Notice Board should be large enough to accommodate information such as reasons for crashes, new software releases, operating system changes, and other official notices of data center activity. A policy of dating and removing messages posted on the board should be established so the board does not become cluttered with outdated information. Additionally, the operator can "post" messages for all on-line users by adjusting the log-in program. The message will be printed out at the user terminal when a user logs into the system. Procedures for initiating these messages are detailed in the DIGITAL IAS System Manager's Guide.

2. DAILY SCHEDULE

The Daily Schedule is the work plan for operations. The schedule serves as a computer time schedule and as an operations guide for the computer operator. It

Exhibit 4-1
U.S. Environmental Protection Agency
Computer Schedule and Notice Board Layout

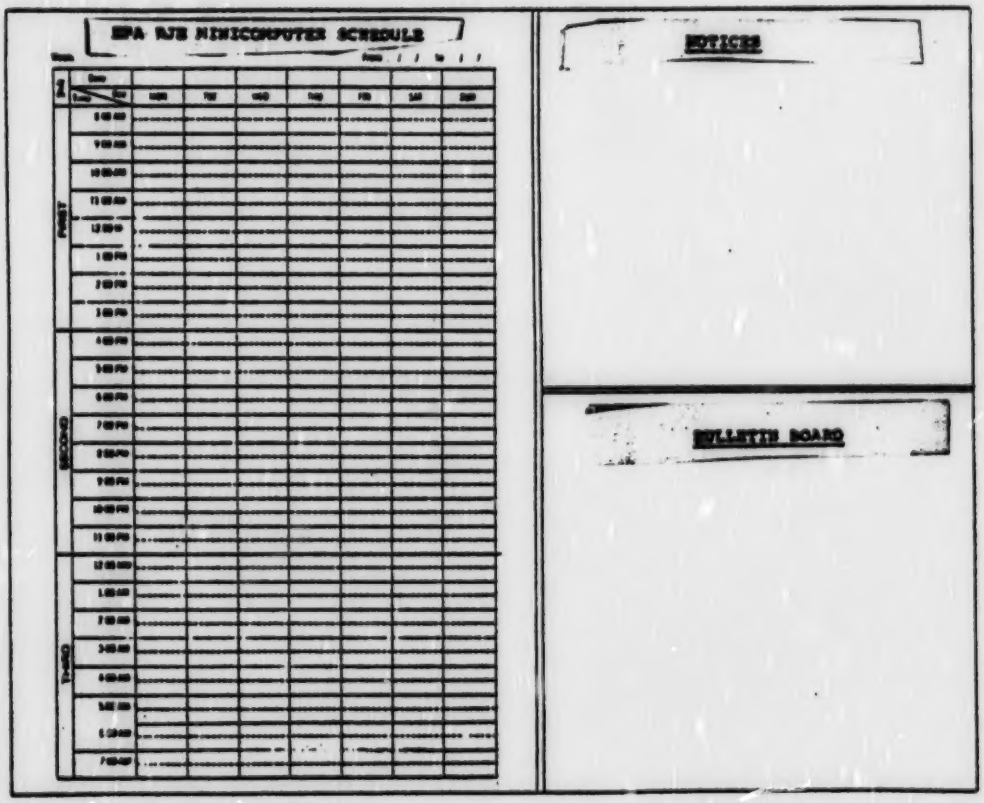
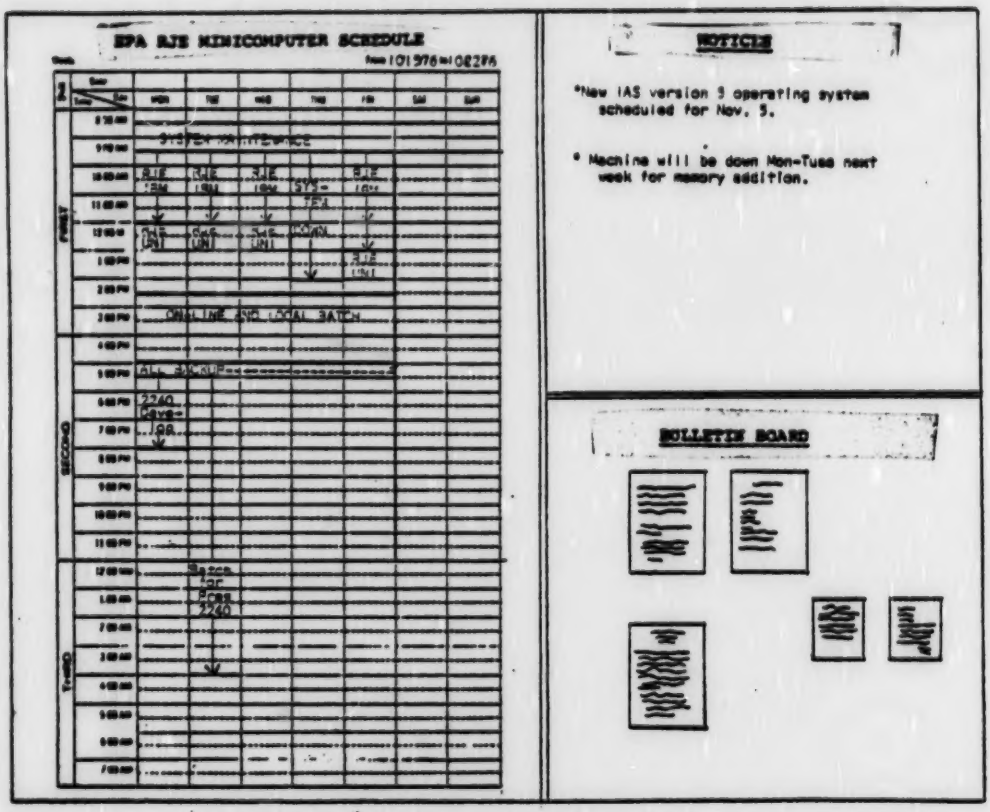


Exhibit 4-2
U. S. Environmental Protection Agency
Sample Computer Schedule and Notice Board


EPA RJE MINICOMPUTER SCHEDULE
NOTICES
*New IAS version 3 operating system scheduled for Nov. 5.
* Machine will be down Mon-Tues next week for memory addition.
BULLETIN BOARD

contains a schedule for six classes of work, as follows:

- Routine production jobs and times at which they are to be run
- Spec. 1 jobs to be run at predetermined times
- Planned maintenance
- Computer availability and priority changes
- Deviations in normal processing procedure
- Special operator instructions related to the day's processing

Exhibit 4-3, on the following page, is an example of a daily schedule.

There is a Daily Schedule for each work day. The schedules should be prepared initially at least two weeks in advance of the day they reference. The schedules should be maintained in a loose-leaf binder. Additions and changes to the schedule can be made as requirements develop.

Short term scheduling of computer time aids in avoiding processing "crunches" and encourages planning among heavy computer system users. For example, the manager should refer to the Daily Schedule in response to a user request for dedicated machine time.

3. RUN BOOK

The Run Book is a collection of instructions listed by job name that explain how the operator is to service various production runs. The purpose of the Run Book is to provide explicit instructions for the operator to follow when processing jobs. Exhibit 4-4, on the following page, is an example of a Run Book entry. Programs that require any servicing outside of job input and output dispatch must have an entry in the Run Book.

When a job requires servicing, a message appears on the operators console. The message references the job name so that the operator can locate the corresponding instructions in the Run Book. The operator performs the requested service and responds to the computer as prescribed in the Run Book.

It is the user's responsibility to insure that Run Book documentation is present and accurate before submitting a job that requires special servicing. The operator should not run any jobs that require servicing but do

Exhibit 4-3
U.S. Environmental Protection Agency
EPA Daily Schedule

Date_____

Page_____of_____

Job Runs

NAME	TYPE	START	APPROX. DURATION	COMMENTS

Misc. Instructions

Exhibit 4-
U.S. Environmental Protection Agency
Sample Run Book Entry

Job Information

User_____ Job Name_____

Phone_____ Page_____of_____

Date_____ Remove Date_____

Job Type

Local Batch ☐ Local On-line ☐ RJE IBM ☐ RJE UNIVAC ☐

_____ ☐

Standard Tape Mount

Tape Name/No._____ _____

Tape Unit 0 Tape Unit 1

Special Paper or Forms

_____

_____

_____

Punch Cards ☐

Operator Instructions

_____

_____

_____

_____

_____

_____

_____

not have a corresponding entry in the Run Book. If a job is run and a request for servicing is made without Run Book instructions, the job should be terminated by the operator.

Use of the Run Book avoids operator confusion and greatly expedites overall job processing. The Run Book provides users with a standard means of giving operator instructions and provides the operator with a standard method of servicing jobs. This allows the manager to assess more easily the quality of service provided to users and to identify any specific problem areas as they occur.

4. JOB SERVICE CARD

Job Service Cards are keypunch sized cards that are supplied by users and accompany all batch job requests. The purpose of the Job Service Card is to provide a convenient means of communication between the operator and users.

The Job Service Card provides the user with a flexible means of requesting special service which may deviate from the normal procedure documented in the Run Book. In such instances, the user should indicate the special instructions on the Job Service Card. For example, a user may request the operator to mount a different tape than the one normally associated with a particular job. The Job Service Card is intended to supplement the Run Book but it should not be considered a substitute for the Run Book. Exhibit 4-5, on the following page, is an example of the Job Service Card.

Occasionally, the operator will have difficulty in processing a job. He should use the Job Service Card to inform the user of the nature of the difficulty. If he has to cancel the job or explain a problem, he should check the appropriate square. He should use the back of the card whenever more detailed explanations are required.

When a user submits a job service card, the operator should attach the card to the appropriate page of the Run Book. After the run is completed, the operator should remove the card from the Run Book, and include it with the user output.

5. OPERATIONS LOG

The Operations Log is a log of the jobs that are run on the computer. The purpose of the log is to provide an accurate historical record of the job processing and servicing. It is an important aid in tracking system

Exhibit 4-5
U.S. Environmental Protection Agency
Job Service Card

EPA JOB SERVICE CARD

User I.D. _____
Date/Time _____
Job _____

Job Type

Local Batch ☐ Local On-line ☐ RTP IBM ☐
RTP UNIVAC ☐ _____ ☐

Standard Tape Mount

Tape Name/No. _____ Tape Unit 2 _____ Tape Unit 1

Punch Cards ☐

Special Paper or Forms

_____
_____
_____

Operator Instructions

_____
_____
_____
_____
_____
_____
_____

Job Cancelled Yes ☐ No ☐

PROBLEM EXPLAINED
ON REVERSE SIDE ☐

throughput and in diagnosing hardware and software failures.

The Operations Log contains information such as the time a job started, console output messages, operator response to the messages, job termination messages, and the time a job finished. Normally, the log consists of the computer console output with notations made by the operator. The notations include messages of system crashes, device failures, or any other events the operator feels should be noted.

6. ENGINEERING LOG

The Engineering Log is a record of hardware failures, maintenance and servicing. It is useful as a source of data on hardware reliability and on vendors' responsiveness to contracted and emergency maintenance. Each device has its own service sheet attached, so the engineering log need only contain summary information about maintenance and servicing. Exhibit 4-6, on the following page, is an example of an engineering log.

When hardware devices fail, the operator should note the problem in the engineering log, call the appropriate vendor field service representative, and inform users via notation on the Computer Schedule Board. When the problem is resolved the operator should record the total repair time and list any replacement parts used in the repair. These notations are required by the terms in the DIGITAL contract.

7. TAPE AND DISK LABELS

Tape and disk labels are a standard set of gummed labels that should always be affixed to any tape or disk pack cover at the data center. The purpose of the labels is to provide a uniform standard for cataloging tapes and disks. The label contains the following information:

- Tape or disk number
- Name of tape or disk
- Name of the user
- Project
- Last date changed

Exhibit 4-7, on the following page, depicts sample tape and disk labels. The operator should provide a new or modified label for a disk or tape each time it is used for

Exhibit 4-6
U.S. Environmental Protection Agency
EPA Minicomputer Engineering Logs

DATE/TIME PROBLEM OCCURRED	NATURE OF PROBLEM	HARDWARE UNIT *	OPERATOR INITIALS	DATE/TIME ENGINEER CONTACTED	DATE/TIME REPAIRED	COMMENTS (Recurring problem, replacement parts, probable cause, etc)

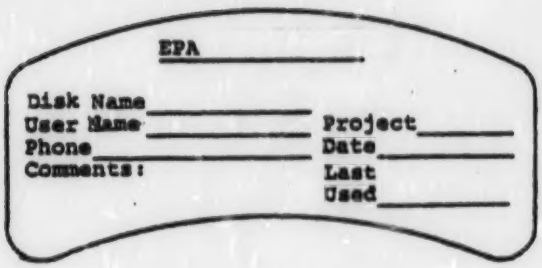
*For DEC Equipment Type and Model Number.

Exhibit 4-7
U.S. Environmental Protection Agency
Tape and Disk Labels

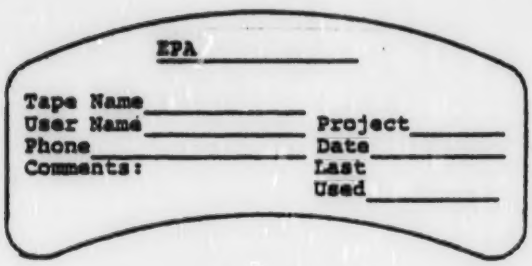
PERMANENT NUMBER

57788

GUMMED DISK LABEL



GUMMED TAPE LABEL



a job. Labels with different colors should be used to distinguish the types of information and ownership of the tapes and disks, e.g., red for backup, blue for operating systems, green for users. Easy identification of tapes and disks greatly reduces the possibility of losing tapes or disks or of erroneously destroying information stored on them. When a new disk or tape is brought into service, a permanent number should be affixed to the tape or disk.

Users should be responsible for tapes not frequently used, since these tapes take space needed for active tapes. The operator should place tapes not used for six months into an inactive tape library. Tapes not used for 1 year should be considered outdated and brought back into service with a new tape number. A list of the "retired" tape numbers should be maintained. The operator is responsible for insuring that this tape policy is posted on the notice board.

8. SOFTWARE MAINTENANCE LOG

The software maintenance log is a record of operating system and vendor provided applications systems failures and corresponding vendor response. It is useful as a source of data on software and vendor reliability. Exhibit 4-7, on the following page, is an example of a software maintenance log.

When there is an operating system failure, the operator should note the problem in the software maintenance log even if no immediate response from DIGITAL software personnel is required. This is necessary to determine if there are any patterns to the system crashes which would require investigation by DIGITAL personnel. When DIGITAL personnel are notified, the operator should record the time of notification and the timeliness and nature of the response by DIGITAL.

Similar procedures should be followed for other vendor provided applications system crashes and vendor maintenance. However, the applications manager should be responsible for keeping a software maintenance log on vendor supplied systems for which he is responsible.

Exhibit 4-8
U.S. Environmental Protection Agency
EPA Software Maintenance Log

DATE/TIME PROBLEM OCCURRED	NATURE OF PROBLEM	VENDOR	OPERATOR INITIALS	DATE/TIME IF VENDOR CONTACTED	DATE/TIME VENDOR RESPONSE	COMMENTS (Recurring problem, probable cause, etc.)

V. ROOM ENVIRONMENT

This chapter describes the procedure for regulating the physical computer room operating environment. In planning the computer room operating procedures, the manager must consider relevant GSA requirements as well as more general machine room housekeeping procedures.

1. GSA REQUIREMENTS

G.S.A. requirements pertaining to computer room environment and safety are listed in the Federal Register, title 41, chapter 101-32.7, Management and Control of Computer Rooms and Related Support Areas. These regula- are applicable to all EPA Remote Job Entry minicomputers. They refer to the control of the computer room environment and associated fire safety practices. These regulations address a number of topics, including specific ones to machine room environment, as follows:

- Noise level
- Personnel traffic and cleanliness
- Employee briefings and computer room inspection
- Precautionary measures
- Emergency fire staff

Managers should incorporate these regulations into their local operations policies.

(1) Noise Level

If the noise level in the room exceeds 90 decibels, then all personnel must be provided with means of adequate protection. Normally, however, the EPA minicomputers will never reach this level unless there is a serious malfunction in the peripheral equipment.

(2) Personnel Traffic and Cleanliness

Only persons authorized by the manager are permitted in the computer room. Smoking, eating, and drinking are prohibited in the computer room and signs stating these restrictions should be posted at all computer room entrances. Telephone service should be provided within the computer room to inhibit unnecessary traffic.

Noncombustible waste baskets with tight fitting or self-closing covers should be present at various locations in the computer room. Card and lineprinter recycling boxes should be located at input and output areas. Personnel coat racks should be kept outside the computer room to minimize dust and lint.

The computer operator should be present if cleaning is done while the computer is running. Personnel assigned to clean the computer room should be given explicit instructions on proper dust-free cleaning procedures. Only cleaning equipment and fluids especially treated for dust and lint content should be used. Any damp mopping of raised computer floors should be done with care to avoid water seepage through the floor joints.

(3) Employee Briefings and Computer Room Inspection

Computer room personnel should be briefed thoroughly, and periodically on maintenance of the computer room environment. Copies of correct maintenance procedures should be distributed to all computer room personnel. The manager should develop a weekly computer room inspection schedule. The inspections should be conducted by a systems analyst or other person who normally does not operate the computer to insure compliance with environmental and maintenance procedures.

(4) Precautionary Measures

False ceilings which conceal steam or water pipes should be checked for discoloration or other signs of leaks. When remedial action is necessary, the manager must notify the proper authority and maintain communications until the problem has been resolved. In most cases, the proper authority will be the GSA building manager or the official responsible for building control.

(5) Fire Emergency Staff

A fire emergency staff should be designated by the manager. The purpose of this staff is to provide guidance during emergencies and to maintain fire safety programs. The staff should become familiar with safety and firefighting procedures and should engage in periodic drills. In the event of a fire, the staff members are responsible for six activities, as follows:

- Reporting the fire
- Evacuating personnel

- Deactivating electrical equipment (except lights)
- Containing the fire until arrival of fire department personnel
- Securing classified material
- Removing any loose equipment or valuable documentation

2. GENERAL MACHINE ROOM HOUSEKEEPING CONSIDERATIONS

Maintaining a clean and orderly machine room reduces the possibility of hardware problems due to excessive dust and debris. The manager can maintain a clean and orderly machine room through six procedures, as follows:

- Post signs to inform personnel that all computer room doors are to be kept closed and that smoking, eating or drinking is prohibited.
- Keep the number of doors in the computer room to a minimum (in keeping with local safety standards and efficient workflow).
- Avoid an arrangement of doors which results in a "corridor" for traffic through the computer room.
- Provide a dustmat at each door.
- Inform the office cleaners of what areas they are and are not to clean, and the special materials that are to be used.
- Avoid the use of dust-holding materials (old carpets, coat racks, etc.) in the immediate vicinity of the computer room.

The computer room operator is responsible for enforcing these provisions. To aid enforcement of the no smoking, eating or drinking regulation, an operator's lounge should be provided in close proximity to the computer room. Computer room telephone lines should be accessible from this lounge.

VI. COMMUNICATIONS

In the EPA data processing environment, communications are the methods of data transmission to and from computers. There are four ways of communicating with the PDP 11, as follows:

- RJE to IBM (remote job entry)
- RJE to UNIVAC
- Local terminals
- Remote terminals

This chapter discusses these communications methods and the associated operator activities for initiating them under the IAS operating system.

1. RJE TO IBM

The PDP 11 can be used to emulate an IBM remote job entry terminal. Jobs for processing can be entered via the PDP 11 peripherals directly to the IBM computer, or they can be queued out to the minicomputer disk to be entered from the disk to the IBM computer at a later time.

Under normal circumstances, all jobs for remote processing should be entered from the minicomputer disk. Data is transmitted faster from a disk than from other minicomputer peripherals, such as a tape drive or card reader.

Printed output from the IBM computer can be processed by the minicomputer in three ways. The output can be printed directly out at the line printer, stored as a minicomputer disk print file, or spooled to the IAS spooler and printed out as part of normal IAS processing. Printed output should be spooled to the IAS spooler. This process is faster than printing the output directly and avoids the effort required to queue up and erase disk print files.

To initiate the IBM emulator, the computer operator should follow the procedures supplied by DIGITAL for RJE/HASP provided by the system manager. There procedures may also be obtained by running the HELP RJE program. The system manager should insure that this program is maintained in the IAS system library.

2. RJE TO UNIVAC

The PDP 11 can be used to emulate UNIVAC remote job entry terminal. Jobs for processing can be entered via the PDP 11 peripherals directly to the UNIVAC computer, or they can be queued out to the minicomputer disk to be entered from the disk to the UNIVAC computer at a later time.

Under normal circumstances, all jobs for remote processing should be entered from the minicomputer disk. To initiate the UNIVAC emulator, the computer operator should follow the procedures supplied by DIGITAL provided by the system manager. The UNIVAC emulator procedures may also be obtained by running the HELP UNI program. The system manager is also responsible for insuring that this program is maintained in the IAS system library.

3. LOCAL TERMINALS

Local terminals are video or hardcopy devices that are connected directly to I/O ports on the PDP 11. They are in the vicinity of the minicomputer (within 40 feet). Local terminals are used to initiate jobs for processing on the minicomputer and for receiving any terminal-directed I/O.

Normal IAS startup procedures will enable all local terminals. The operator is not required to perform any special activities to initiate local terminal processing.

4. REMOTE TERMINALS

Remote terminals are video or hardcopy terminals that are connected to the PDP 11 via telephone lines. Remote terminals are used for the same functions as local terminals.

Normal IAS startup procedures will activate the PDP 11 "dial-up" ports for remote terminals. Remote terminal users are required to dial into the minicomputer. The computer operator should insure that all computer room data set lines are set for remote terminal input. The system manager should insure that the proper settings are marked on the data sets.

APPENDIX A -- IAS DOCUMENTATION DIRECTORY

This appendix contains the DEC published IAS Documentation Directory. The directory defines the intended readership of each IAS manual and provides a synopsis of each manuals' content. Table 1 is especially helpful in determining the intended audience of the manuals. All manuals are included in the IAS Pre-delivery kit. The computer operator should pay special attention to the entire IAS User's Guide and chapters 2, 4, 5, 8, and 9 of the IAS Management Guide. The IAS User's Guide is a description of the PDS command language, the basic method of communication with the IAS operating system. The chapters in the IAS Management Guide are a description of IAS system concepts, IAS starting procedures, and the SCI command language, the basic method of controlling the IAS run time system.

CONTENTS (Cont.)

Page

TABLES

TABLE 1 IAS Documentation Set 2

DEC-11-OIDDA-B-D

.READ THIS FIRST

IAS Documentation Directory

May 1976

IAS Version 1.1

This document describes the manual set that is part of the IAS Version 1.1 Distribution Kit. It defines the intended readership of each manual and provides a brief synopsis of each manual's contents.

Table 1
IAS Documentation Set

VOLUME	DOCUMENT TITLE	AUDIENCE (see KEY)			
		Operator	System Manager	System Programmer	Applications Programmer
VOLUME 1A System Reference Information	IAS Documentation Directory	X	X	X	X
	IAS System Release Notes	X	X	X	X
	IAS Executive Reference Manual Volume I		X	X	X
	IAS Executive Reference Manual Volume II		X	X	
	IAS/RSX-11 I/O Operations Reference Manual			X	
	RSX-11D FORTRAN Special Subroutines Reference Manual			X	X
VOLUME 1B System Reference Information	IAS/RSX-11D Device Handlers Reference Manual			X	
	IAS/RSX-11D Guide to Writing a Device Handler Task			X	
	IAS/RSX-11D ICS/ICR Subsystems Handler Reference Manual[1]			X	
	IAS/RSX-11D ICS/ICR Subsystems Release Notes[1]			X	
	IAS/RSX-11 MACRO-11 Reference Manual			X	X
VOLUME 2 System Procedures	IAS User's Guide	X	X	X	X
	IAS Task Builder Reference Manual			X	X
	IAS Editing Utilities Reference Manual	X	X	X	X
	IAS/RSX-11 ODT Reference Manual			X	X

[1]Optional software; available under separate license.

CONTENTS

		Page
1.0	ORGANIZING THE MANUALS	1
2.0	DOCUMENT DESCRIPTIONS	6
2.1	IAS System Release Notes (DEC-11-OISRA-B-D)	6
2.2	IAS Executive Reference Manual - Volume I (DEC-11-OIE1A-A-D)	6
2.3	IAS Executive Reference Manual - Volume II (DEC-11-OIE2A-A-D)	6
2.4	IAS/RSX-11 I/O Operations Reference Manual (DEC-11-OIORA-A-D)	6
2.5	RSX-11D FORTRAN Special Subroutines Reference Manual (DEC-11-LFSMA-B-D)	6
2.6	IAS/RSX-11D Device Handlers Reference Manual (DEC-11-OIHRA-A-D)	6
2.7	IAS/RSX-11D Guide to Writing a Device Handler Task (DEC-11-OIDHA-A-D)	7
2.8	IAS/RSX-11D ICS/ICR Subsystems Handler Reference Manual (DEC-11-UIRMA-A-D)	7
2.9	IAS/RSX-11D ICS/ICR Subsystems Handler Release Notes (DEC-11-UIRNA-A-D)	7
2.10	IAS/RSX-11 MACRO-11 Reference Manual (DEC-11-OIMRA-A-D)	7
2.11	IAS User's Guide (DEC-11-OIUGA-B-D)	7
2.12	IAS Task Builder Reference Manual (DEC-11-OITBA-A-D)	7
2.13	IAS Editing Utilities Reference Manual (DEC-11-OIEUA-A-D)	8
2.14	IAS/RSX-11 ODT Reference Manual (DEC-11-OIODA-A-D)	8
2.15	IAS System Management Guide (DEC-11-OISMA-B-D)	8
2.16	IAS System Generation Guide (DEC-11-OISGA-B-D)	8
2.17	RSX-11D Diagnostics Reference Manual (DEC-11-OXLDA-B-D)	8
2.18	BASIC-11 Language Reference Manual (DEC-11-LIBBA-B-D)	8
2.19	IAS BASIC User's Guide (DEC-11-LIBIA-A-D)	9
2.20	IAS BASIC Installation Guide (DEC-11-LIBJA-A-D)	9
2.21	PDP-11 COBOL Language Reference Manual (DEC-11-LCOBA-C-D)	9
2.22	PDP-11 COBOL User's Guide (DEC-11-LCUGA-B-D)	9
2.23	PDP-11 COBOL Installation Guide (DEC-11-LCIDA-B-D)	9
2.24	PDP-11 SORT Reference Manual (DEC-11-USTMA-B-D)	9
2.25	PDP-11 FORTRAN Language Reference Manual (DEC-11-LFLRA-C-D)	9
2.26	IAS/RSX-11 FORTRAN IV User's Guide (DEC-11-LMFUA-C-D)	10
2.27	IAS/RSX-11 FORTRAN IV Installation Guide (DEC-11-LFIGA-A-D)	10
2.28	FORTRAN IV-PLUS User's Guide (DEC-11-LFPUA-B-D)	11
2.29	FORTRAN IV-PLUS OTS Reference Manual (DEC-11-LFPOA-A-D)	11
2.30	FORTRAN IV-PLUS Installation Guide (DEC-11-LFPGB-B-D)	11

FIGURES

FIGURE 1 IAS Documentation Roadmap 5

Table 1 (Cont.)
IAS Documentation Set

KEY: Operator is responsible for routine handling of system operation under direction of system manager.

System manager is responsible for overall operation of system.

System programmer (analyst) is concerned with programming special I/O devices and/or real-time programming.

Applications programmer is a high-level language user (FORTRAN, BASIC, or COBOL).

IAS DOCUMENTATION DIRECTORY

The purpose of this document is to describe the manuals contained in the distribution kit and to direct the reader to manuals appropriate to particular interests and needs.

1.0 ORGANIZING THE MANUALS

The documentation set is divided into four volumes distributed across seven binders, as shown below:

Volumes 1A and 1B -- System Reference Information

Volume 2 -- System Procedures

Volume 3 -- System Management Information

Volumes 4A, 4B, and 4C -- Language Manuals (Optional Software)

Seven spine inserts are provided to identify each binder. Place these inserts in the pockets of the binders. For each binder, tabbed divider pages of heavy card stock are also provided. In assembling the manuals, place these divider tabs appropriately in each binder. To facilitate access to the manuals, the order of the manuals in each binder should represent the order specified by the spine insert.

Table 1 lists the manuals by volume and defines the intended readership of each document.

Figure 1 suggests a reading path for acquiring an overall familiarity with the system.

2.0 DOCUMENT DESCRIPTIONS

The information contained in each manual in the IAS documentation set is summarized below. Refer to Figure 1 for a suggested reading path.

2.1 IAS System Release Notes (DEC-11-OISRA-B-D)

This document lists the software components of the distribution kit, describes the constituent files, and provides information of general interest to the system manager and system programmers in preparation for generating the target system on the host computer. Known bugs and documentation errors (if present) are also summarized in this document for the reader's convenience.

2.2 IAS Executive Reference Manual - Volume I (DEC-11-OIE1A-A-D)

This document is designed for the writer of non-privileged (timesharing) programs, expanding on topics covered in the IAS User's Guide. Many general subjects (e.g., IAS input/output, the Task Builder, overlays, sharable global areas) are introduced in this manual, and references to other manuals in the set are provided for more detailed information.

2.3 IAS Executive Reference Manual - Volume II (DEC-11-OIE2A-A-D)

Expanding on the timesharing facilities in Volume I, this document describes all the real-time privileged facilities available to the IAS user. The allocation of memory and partitions, the real-time PDS commands, the system directives and facilities for real-time programming, the system communications area (SCOM), and the timesharing data structures are covered in this manual.

2.4 IAS/RSX-11 I/O Operations Reference Manual (DEC-11-OIORA-A-D)

This document provides programmer reference information needed for using the IAS/RSX-11 file control system. All the macro calls for performing logical I/O operations and file control functions are described, as well as the file structures for disk and magnetic tape devices.

2.5 RSX-11D FORTRAN Special Subroutines Reference Manual (DEC-11-LFSMA-B-D)

This document provides information for using system subroutines that are designed to be used by FORTRAN programs. These subroutines perform process control and RSX-11D system directive operations.

2.6 IAS/RSX-11D Device Handlers Reference Manual (DEC-11-OIHRA-A-D)

Detailed in this document are the functions performed by the device handler tasks that service the standard peripheral devices supported by the system.

Table 1 (Cont.)
IAS Documentation Set

VOLUME	DOCUMENT TITLE	AUDIENCE (see KEY)			
		Operator	System Manager	System Programmer	Applications Programmer
VOLUME 3 System Management Information	IAS System Management Guide	X	X		
	IAS System Generation Guide		X	X	
	RSX-11D Diagnostics Reference Manual		X		
VOLUME 4A Optional Software[1] BASIC	BASIC-11 Language Reference Manual				X
	IAS BASIC User's Guide				X
	IAS BASIC Installation Guide		X		
VOLUME 4B Optional Software[1] COBOL	PDP-11 COBOL Language Reference Manual				X
	PDP-11 COBOL User's Guide				X
	PDP-11 COBOL Installation Guide		X		
	PDP-11 SORT Reference Manual				X
VOLUME 4C Optional Software[1] FORTRAN	PDP-11 FORTRAN Language Reference Manual				X
	IAS/RSX-11 FORTRAN IV User's Guide				X
	IAS/RSX-11 FORTRAN IV Installation Guide		X		
	FORTRAN IV-PLUS User's Guide				X
	FORTRAN IV-PLUS OTS Reference Manual			X	X
	FORTRAN IV-PLUS Installation Guide		X		

[1]Available under separate license.

2.13 IAS Editing Utilities Reference Manual (DEC-11-OIEUA-A-D)

This document describes two commonly used editors. The Text Editor (EDIT) is an interactive, context editor that facilitates the creation and modification of symbolic source programs and other ASCII text material. The Source Language Input Editor (SLIPER) is a batch-oriented editor that is used to maintain source language files stored on disk.

2.14 IAS/RSX-11 ODT Reference Manual (DEC-11-OIODA-A-D)

Intended for use in program development, this document is directed to the user who wishes to make on-line alterations to a program or merely to observe what is happening during its execution. This document assumes that the reader is familiar with the PDP-11 instruction set and MACRO-11 programming.

2.15 IAS System Management Guide (DEC-11-OISMA-B-D)

This document, directed primarily to the system manager and system operator, presents information aimed at efficient, effective use of the system. How the system can be tailored to accommodate varying local processing requirements is also described. The document consists of three parts: a tutorial, privileged system management commands, and diagnostics and system back-up procedures. The tutorial presentation describes memory organization, system components, IAS start-up, system parameters, device and file management, spooling, checkpointing, and accounting. The second part describes, in alphabetical order, the start-up commands, the SCI and PDS commands, and the special system commands. The third part describes the Core Dump Analyzer, error logging, diagnostics, the Preserve program, and parity support.

2.16 IAS System Generation Guide (DEC-11-OISGA-B-D)

This document provides information needed to bootstrap the system, transfer the contents of the distribution medium onto the system disk, and perform a system generation to tailor the IAS software to suit the characteristics of the host computer system.

2.17 RSX-11D Diagnostics Reference Manual (DEC-11-OXLDA-B-D)

This document is intended for the system manager and/or the Digital Field Service Engineer for use in diagnosing hardware malfunctions. Diagnostic tasks for disks, magnetic tape drives, DECtape drives, and terminal devices are described, and operational information for invoking the tasks is provided. Because the diagnostic routines are run as tasks, they can execute concurrently with other system and user tasks without affecting normal system operations.

2.18 BASIC-11 Language Reference Manual (DEC-11-LIBBA-B-D)[1]

This document describes the BASIC language elements, as implemented for the PDP-11 computer under IAS. The statements, functions, and commands available under IAS BASIC are covered in this document.

[1]Optional software; available under separate license.

IAS INSTALLATION DIRECTORY

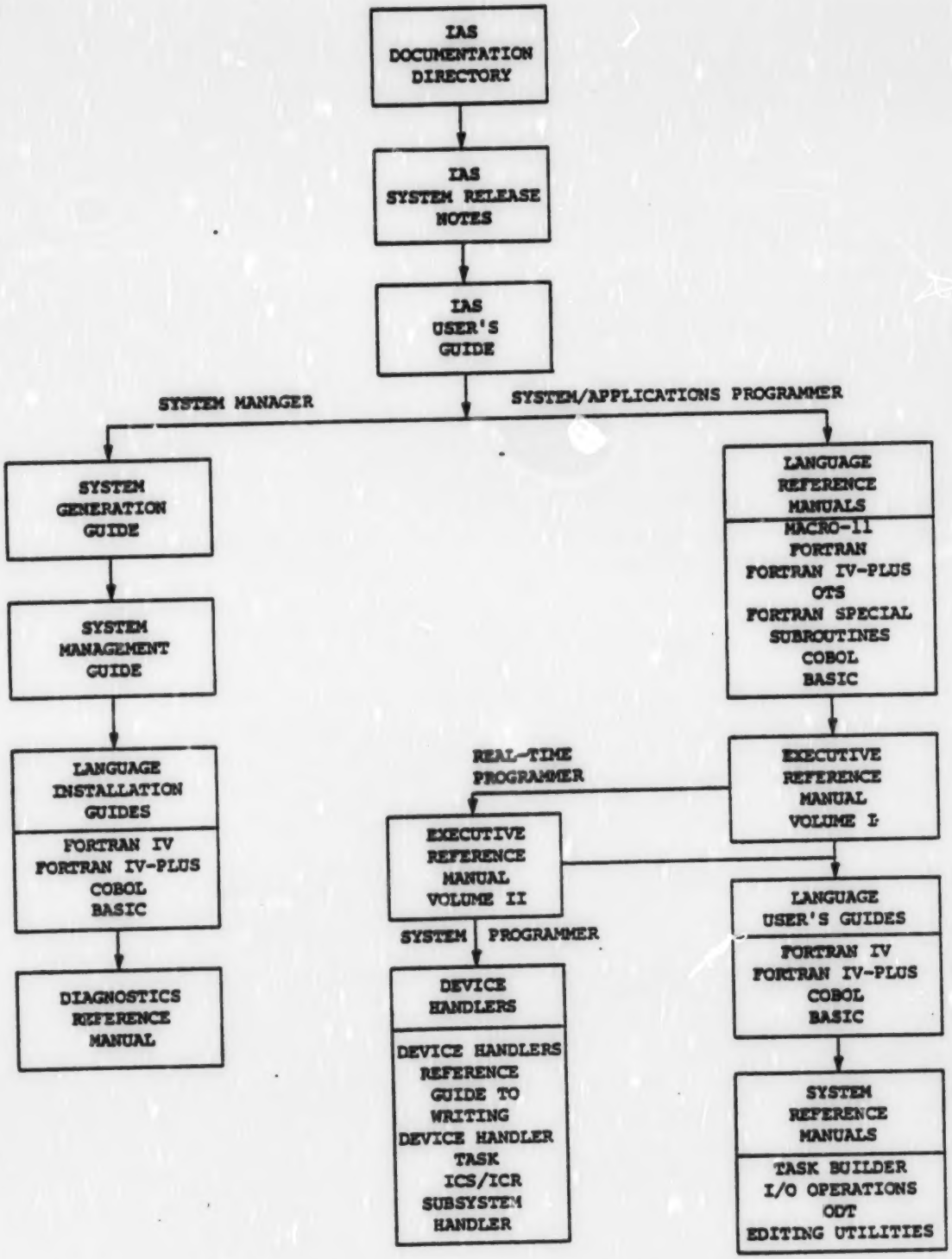


Figure 1
IAS Documentation Roadmap

This document is a reference manual; while it can be used by an inexperienced FORTRAN programmer, it is not intended as a tutorial. Because this document is designed to span multiple operating systems, it does not contain any system-dependent information. Associated with this document, therefore, are the corresponding FORTRAN User's Guides for respective operating systems.

2.26 IAS/RSX-11 FORTRAN IV User's Guide (DEC-11-LMFUA-C-D)[1]

This document provides the information necessary to compile, task build (link), execute and debug a FORTRAN IV program under the RSX-11M, RSX-11D, and IAS operating systems. The document consists of four chapters:

Chapter 1	presents operating procedures,
Chapter 2	describes the Object Time System (OTS),
Chapter 3	describes the system-dependent information not included in the PDP-11 FORTRAN Language Reference Manual, and
Chapter 4	describes methods of increasing program efficiency.

The appendices pr[illegible]information on FORTRAN internal data representations, system subro[illegible]es, error diagnostics, and compatibility of FORTRAN IV with other PDP-11 FORTRAN processors.

This document should be used only after some knowledge of the PDP-11 FORTRAN language has been acquired (via the PDP-11 FORTRAN Language Reference Manual). However, an understanding of the information presented in this document is a prerequisite to effective use of the processor. The user is assumed to be familiar with the local operating system and its associated documentation.

2.27 IAS/RSX-11 FORTRAN IV Installation Guide (DEC-11-LFIGA-A-D)[1]

This document provides complete instructions for installing the FORTRAN IV system on the RSX-11M Version 2, RSX-11D Version 6, and IAS Version 1 operating systems from the components supplied with the distribution media. This document also describes the minimal system requirements, compiler options, and a system-build verification procedure.

It is strongly recommended that the system manager read this document in its entirety before attempting to install FORTRAN IV.

---

[1] Optional software; available under separate license.

2.7 IAS/RSX-11D Guide to Writing a Device Handler Task (DEC-11-OIDHA-A-D)

This document serves as a MACRO-11 programmer's reference source containing the information needed by a user to code a device handler task for a peripheral device that is not supported by the standard system.

2.8 IAS/RSX-11D ICS/ICR Subsystems Handler Reference Manual (DEC-11-UIRMA-A-D)[1]

This document describes the methods for accessing ICS/ICR-supported industrial control modules. These subsystems interrogate digital and analog input, and drive digital and analog output under program control. Programs can be written in either FORTRAN or assembly language.

2.9 IAS/RSX-11D ICS/ICR Subsystems Handler Release Notes (DEC-11-UIRNA-A-D)[1]

This document discusses an acceptance test for the ICS/ICR subsystems handler, and provides a correction for a known software problem.

2.10 IAS/RSX-11 MACRO-11 Reference Manual (DEC-11-OIMRA-A-D)

The assembler language supported by IAS and RSX-11 is described in this document. Also included are sections describing suggested programming standards (and the benefits deriving from their use), operating procedures, and methods of writing position-independent code.

2.11 IAS User's Guide (DEC-11-OIUGA-B-D)

This document describes the PDS command language and its use in interactive and batch processing. The document is divided into two parts. Part I is a tutorial which teaches the reader how to use the PDS commands to perform various functions, e.g., how to create, edit, and manipulate files, how to access devices, compile and run programs, etc. Part II is a directory of all the non-privileged PDS commands, describing each command in full detail. Several appendices contain tables of frequently-referenced information.

An understanding of the information presented in this document is a prerequisite to effective use of the system and a further perusal of the other manuals in the set.

2.12 IAS Task Builder Reference Manual (DEC-11-OITBA-A-D)

A description of the Task Builder and the overlay descriptor language is provided in this document. Both programmer reference information and operational information are provided. Also included is a description of the Librarian, a utility program which allows the user to create, update, modify, list, and maintain object library files.

---

[1]Optional software; available under separate license.

2.19 IAS BASIC User's Guide (DEC-11-LIBIA-A-D)[1]

This document describes the general file descriptor format, the system commands, the error messages, and the procedures for initiating BASIC. Some features of the language not covered in the BASIC-11 Language Reference Manual are also presented in this document.

2.20 IAS BASIC Installation Guide (DEC-11-LIBJA-A-D)[1]

This document contains all the information needed to create a working BASIC system from the software distribution kit.

2.21 PDP-11 COBOL Language Reference Manual (DEC-11-LCOBA-C-D)[1]

The COBOL language elements, as implemented for the PDP-11 computer, are described in this document. It is based on the document American National Standard COBOL, X3.23 - 1974, both for organization and content. Shading in the manual denotes PDP-11 extensions.

2.22 PDP-11 COBOL User's Guide (DEC-11-LCUGA-B-D)[1]

The information required by the applications programmer to compile, execute, and debug COBOL programs in any PDP-11 operating environment is provided in this document. Also, it contains additional information on the compiler, the run-time system, COBOL utility programs, and a complete list of the COBOL error messages.

2.23 PDP-11 COBOL Installation Guide (DEC-11-LCIDA-B-D)[1]

This document provides complete instructions for preparing and installing the COBOL system for use in any PDP-11 operating environment from the components supplied with the distribution media. Information about using different COBOL configurations is supplied in addition to a description of the standard installation method.

2.24 PDP-11 SORT Reference Manual (DEC-11-USTMA-B-D)[1]

This document describes the features and the operation of the SORT utility program. The SORT utility sorts data files into ascending or descending order.

2.25 PDP-11 FORTRAN Language Reference Manual (DEC-11-LFLRA-C-D)[1]

This document describes the language elements for both FORTRAN IV and FORTRAN IV-PLUS, as implemented for the PDP-11 computer. Shading in the manual denotes the FORTRAN IV-PLUS features.

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[1]Optional software; available under separate license.

EPA RUNBOOK INSTRUCTIONS

Job Information

User_____ Job Name_____

Phone_____ Page_____of_____

Date_____ Remove Date_____

Job Type

Local Batch ☐ Local On-line ☐ RJE IBM ☐ RJE UNIVAC ☐

_____ ☐

Standard Tape Mount

Tape Name/No._____ _____

Tape Unit ∅ Tape Unit 1

Special Paper or Forms

_____

_____

_____

Punch Cards ☐

Operator Instructions

_____

_____

_____

_____

_____

_____

_____

2.28 FORTRAN IV-PLUS User's Guide (DEC-11-LFPUA-B-D)[1]

This document provides the information necessary to compile, task build (link), execute, and debug a FORTRAN IV-PLUS program under the RSX-11M, RSX-11D, and IAS operating systems. The document consists of four chapters:

Chapter 1 presents operating procedures,

Chapter 2 describes the Object Time System (OTS),

Chapter 3 describes the system-dependent information not included in the PDP-11 FORTRAN Language Reference Manual, and

Chapter 4 describes methods for effectively utilizing the FORTRAN IV-PLU system.

The appendices provide information on FORTRAN internal data representations, system subroutines, error diagnostics, mathematical library algorithms, and compatibility of FORTRAN IV-PLUS with other PDP-11 FORTRAN processors.

This document should be used only after some knowledge of the PDP-11 FORTRAN language has been acquired (via the PDP-11 FORTRAN Language Reference Manual). However, an understanding of the information in this document is a prerequisite to effective use of the processor. The user is assumed to be familiar with the local operating system and its associated documentation.

2.29 FORTRAN IV-PLUS OTS Reference Manual (DEC-11-LFPOA-A-D)[1]

This document describes the FORTRAN IV-PLUS Object Time System (OTS). This document supplies more detail than is provided in the FORTRAN IV-PLUS User's Guide. The information in this document is not needed for normal use of FORTRAN IV-PLUS. However, this document should be especially useful for programmers who wish to combine MACRO-11 and FORTRAN routines.

The user is assumed to be proficient in MACRO-11 and FORTRAN programming and to be familiar with the contents of the FORTRAN IV-PLUS User's Guide.

2.30 FORTRAN IV-PLUS Installation Guide (DEC-11-LFPGB-B-D)[1]

This document describes the procedures for installing the FORTRAN IV-PLUS system on the RSX-11M Version 2, RSX-11D Version 6, and IAS Version 1 operating systems from the components supplied with the distribution media. This document also describes the minimal system requirements, the files distributed in the kit, options available for planning and tailoring the system to user needs, the release notes, and a system-build verification procedure.

It is strongly recommended that the system manager read this document in its entirety before attempting to install FORTRAN IV-PLUS.

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[1] Optional software; available under separate license.

EPA MINICOMPUTER ENGINEERING LOG

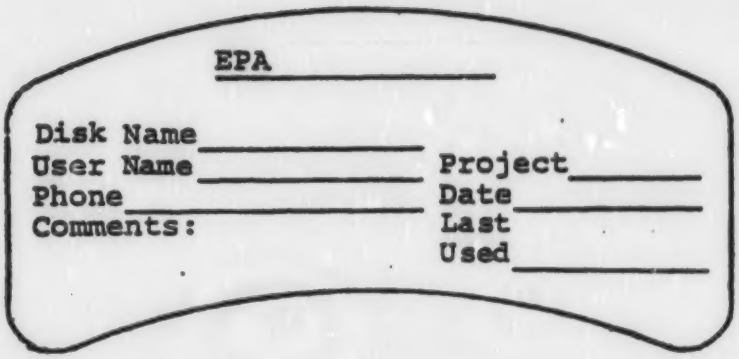
DATE/TIME PROBLEM OCCURRED	NATURE OF PROBLEM	HARDWARE UNIT *	OPERATOR INITIALS	DATE/TIME ENGINEER CONTACTED	DATE/TIME REPAIRED	COMMENTS (Recurring problem, replacement parts, probable cause, etc)

*For DEC Equipment Type and Model Number.

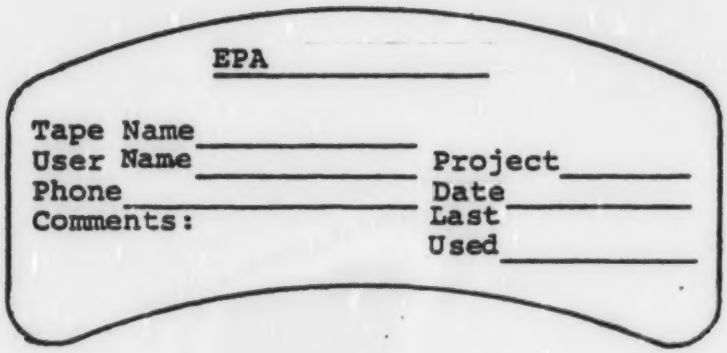
APPENDIX B -- SAMPLE DOCUMENTS

EPA DISK AND TAPE LABELS

GUMMED DISK LABEL



GUMMED TAPE LABEL



EPA DAILY SCHEDULE

Date_____

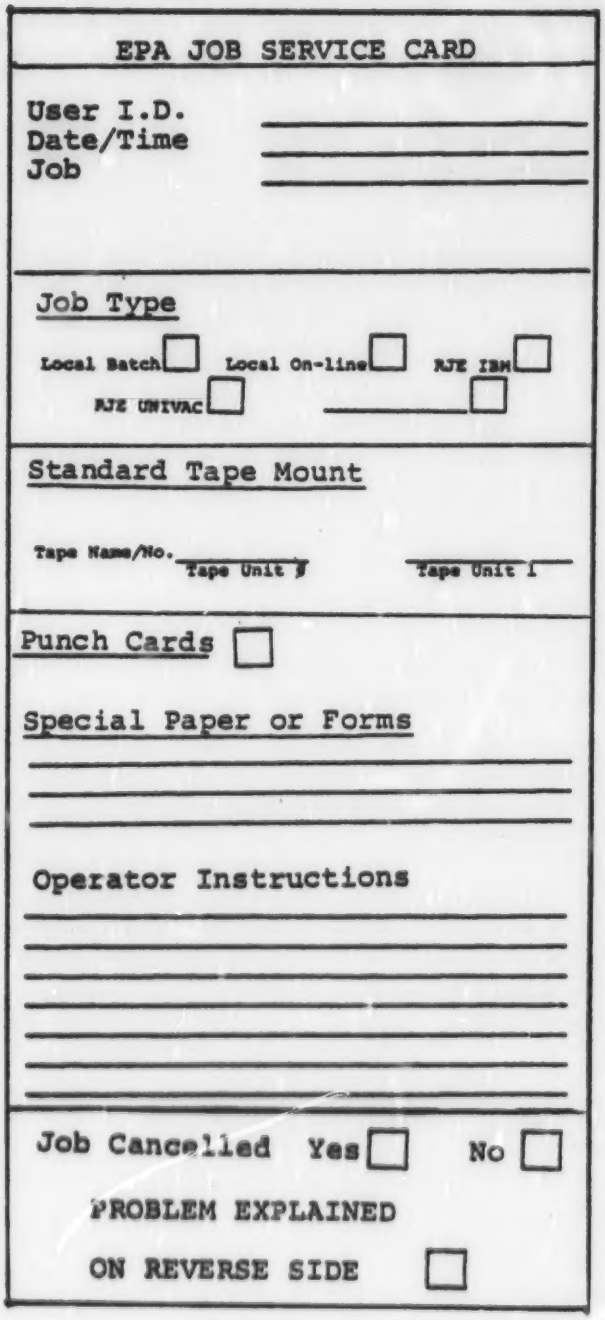
Page_____of_____

Job Runs

NAME	TYPE	START	APPROX. DURATION	COMMENTS

Misc. Instructions

EPA JOB SERVICE CARD



assemble	To translate from a symbolic program to a binary program by substituting binary operation codes for symbolic operation codes and absolute or relocatable addresses for symbolic addresses.
assembler	A program that performs the translation from symbolic program to binary program.
asynchronous	Not synchronous. An asynchronous device is one which does not require all elements of that device to be operating in time coincidence.
*autodecrement	An address mode in the PDP-11 system that decrements the contents of a selected register before the register is used. This mode can step the register to the next lower byte (decrement by 1) or word (decrement by 2).
*autoincrement	An address mode in the PDP-11 system that increments the contents of a selected register after the register is used. This mode increments by 1 (byte) or 2 (word).
*autoindex	The process of autoincrementing or autodecrementing the value (±1 or ±2) by which an address is autoincremented or autodecremented.

B

background processing	Automatic execution of lower priority computer programs when higher priority programs are not using the system resources.
*bidirectional	Capable of traveling in either direction. Refers to Unibus lines on which signals can be transmitted or received.
binary	Pertaining to a number system with a radix of 2.
binary digit	One of the two states (0 or 1) of the binary number system. Usually referred to as a bit.
binary program	A short utility program which, when loaded, instructs the computer to read binary-coded data punched on paper tape and store it in core memory.
bit	A shortened form of binary digit; the smallest unit of information.
block transfer	Moving a large amount of data in one operation. For example: data from a disk into memory or vice versa.
bootstrap	A technique or device designed to bring itself into a desired state by means of its own action. For example, a routine whose first few instructions are sufficient to bring the rest of itself into the computer from an input device.
*bootstrap loader	A program that is toggled into the computer to allow a small set of programs in a special tape format to be loaded into the PDP-11.
boundary	See "word boundaries."

EPA SOFTWARE MAINTENANCE LOG

DATE/TIME PROBLEM OCCURRED	NATURE OF PROBLEM	VENDOR	OPERATOR INITIALS	DATE/TIME IF VENDOR CONTACTED	DATE/TIME VENDOR RESPONSE	COMMENTS (Recurring problem, probable cause, etc.)

B.6

checksum	A value representing the sum of all bytes in a program. When the program is loaded, the sum of the bytes can be compared with the checksum to make sure that the entire program has been loaded correctly.
clear	To erase the contents of a storage location by replacing the contents with zeros; to set register and/or flip-flops in a device to the required initial states.
clock	A device that generates regular periodic signals for synchronization.
coding	To write instructions for a computer using symbols meaningful to the computer or to an assembler, compiler, etc.
command	A control signal, usually written as a character or group of characters, that is used to direct the action of a system program.
compile	To produce a binary-coded program from a program written in source (symbolic) language, by selecting appropriate subroutines from a subroutine library (as directed by the instructions or other symbols in the source program).
compiler	A program that produces a binary-coded program from a source (symbolic) program.
complement	The binary opposite of a number, variable, or function. See "one's complement" and "two's complement."
*condition codes	The four least significant bits of the processor status word. These bits monitor different results of previous operations. The four functions monitored are: zero, negative, carry, and overflow.
conditional branch	A branch that takes place only if a predetermined condition has been met.
conditional jump	A jump that occurs only if specified criteria have been met.
console	An external panel on the computer or peripheral where controls and indicators are available for manual monitoring and operating of the device.
control	A circuit or device used to provide a sequence of levels and/or pulses which cause a system or subsystem to carry out certain procedures.
*control and status register	A register, used with a peripheral, that contains information needed to communicate with the peripheral.
controller	See "dedicated controller."
*core memory	A read/write random access memory using ferrite cores as storage elements. In the PDP-11 system, core memory refers to the MM11-E memory normally used as the basic system memory.
crosstalk	Unwanted insertion of a signal from an adjacent channel.
crowbar	A large power bus normally used to pass excess voltage to ground if an overvoltage condition exists.

D

data	A general term used to denote any or all facts, numbers, letters, and symbols. It connotes basic elements or information which can be processed or produced by a computer.
data buffer register	A register used with a peripheral to temporarily store data that is to be transferred into or out of the processor or other device.
*data paths	That portion of the KA11 processor where normal processing and computation occurs. All modifications and routing of data within the processor are performed by the data paths which consist primarily of the input gating and latches, adder, and output gating circuits.

APPENDIX C -- PDP-11 GLOSSARY

	because required search time is significantly less. Most disks can store considerably greater amounts of data than core memories.
display	A peripheral device used to portray data graphically. Normally refers to some type of cathode-ray tube system.
*double-operand	PDP-11 instructions that contain two address fields: one field for the source operand, and one field for the destination operand; two-address instruction.
double-precision	Pertaining to the use of two computer words to represent one number.
downtime	The time interval during which a device or system is inoperative.
driver	See "bus driver." Also refers to a software routine designed to interface directly to a device. For example, a disk driver.
dump	To copy the contents of all or part of the core memory, usually on to some external storage medium such as hard copy or paper tape.
*dynamic master-slave relationship	Indicates that control of the Unibus may be passed from a master to another peripheral which then becomes master. It is not necessary to first pass control back to the processor. See "master-slave."
E	
edit	To arrange and/or alter information for machine input or output.
editor	A program that allows the user to produce edit symbolic files on line.
*effective address	The address actually used in the execution of a computer instruction.
emulator	A hardware device that permits a program written for a specific computer to be run on a different type of computer system.
*emulator trap	A PDP-11 instruction that calls an emulator routine.
enable	To set up conditions so that a specific device, circuit, or signal can be used. The opposite of inhibit.
end-around carry	The action of adding the most significant bit of a binary number to the least significant bit position.
execute	To carry out a specified instruction or to run a program on the computer.
*execute major state	A PDP-11 major state during which the specified instruction is performed.
executive routine	A routine that controls or monitors execution of other routines.
exit	To leave. Specifically, to leave a main program in order to enter a subroutine or vice versa.
explicit address	See "absolute address."
*external device	Peripheral. In the PDP-11 system, any device connected to the Unibus with the exception of the processor.
*external page	Addresses above 160000 which are reserved for device register and processor register addresses.
F	
fanout	A number indicating the number of unit loads a specific output signal can drive.
fetch	The act of obtaining and decoding an instruction from the program.
*fetch major state	A PDP-11 major state during which the next program instruction is obtained and decoded, and a determination made as to what major state to enter next, based on the type of instruction decoded.

PDP-11 GLOSSARY

A

*absolute address	A binary number that is permanently assigned as the address of a storage location.
*absolute loader	A routine that allows the user to load blocks of code and data from paper tape punched in the absolute binary format.
access time	The time interval between the instant at which data is called for (or requested to be stored) from a storage device and the instant delivery (or storage) is started.
accumulator	A 16-bit register or memory location in which the result of an operation is formed.
*active release	Pertains to the Unibus. Indicates that the bus control is passed from the bus master to the processor by means of an interrupt operation. See "passive release."
address	A label, name, or number which designates a location where information is stored.
address field	That portion of a computer word either containing the address of the operand or containing the information necessary for calculation of the address.
*address selector	The M105 logic module used to decode an address from the processor to select up to four-word or eight-byte external registers.
address map	A table, chart or drawing showing the absolute addresses of all locations in the core memory.
algorithm	A prescribed set of well-defined rules or processes for the solution of a problem in a definite sequence.
alphanumeric	Pertaining to a character set that contains any of the 26 letters and 10 numerals.
analog-to-digital converter	A peripheral device that receives an analog signal and transforms it to an equivalent digital value.
AND gate	A circuit with multiple inputs that provides the desired output only when signals representing assertion are present at all inputs.
arithmetic unit	The component of a computer where arithmetic and logical operations are performed.
argument	An independent variable. For example, in looking up a quantity in a table, the number (or numbers) that identifies the location of the desired value.
ASCII	American Standard Code for Information Interchange. A standard code, using a coded character set consisting of eight-bit coded characters, used for data interchange among data processing communication systems and equipment. The code set includes both graphic and control characters.

*Although these terms are used in other systems, here their definitions apply solely to the PDP-11.

interface	The hardware needed to allow communication between the system Unibus and the peripheral.
*interlocked	The interrelation of communication between the Unibus master and slave devices. This relation is such that for each control signal from the master, the slave must send a response before the operation continues.
internal storage	The storage facilities forming an integral physical part of the computer and directly controlled by the processor.
*interrupt	A temporary disruption of normal operation by a special signal from the computer or peripheral.
*interrupt control	The M782 logic module which contains necessary logic circuits to allow a peripheral device to gain control of the Unibus and perform a program interrupt.
*interrupt vector	Two locations containing processor status word and the program counter value which indicates the starting point of the interrupt routine.
I/O device	See "peripheral" or "external device."
J	
jump	A departure from the normal sequence of executing instructions in a program. An unconditional jump causes the program to go to the specified location in the program; a conditional jump causes the program to go to the new location only if preestablished criteria have been met.
L	
language	A set of representations, conventions, and rules used to convey information.
*last in, first out	A storage/retrieval method in which the last item stored is the first item retrieved.
*latch	A circuit that locks data into the processor input gates so that output states are maintained even when the input signals are removed. The latches are functionally part of the "data paths."
latency	The time delay involved while waiting for specified data to reach a desired point or while waiting for a specified response which must arrive prior to further processing.
leader	The blank section at the beginning of a magnetic or paper tape. In certain cases (such as the absolute loader) the loader is punched in a special format.
least-significant bit	The rightmost bit in a byte or word.
least-significant digit	The rightmost digit of a number.
level	A voltage that remains constant for a long time. There are two possible levels: low or high.
list	Usually refers to related data that occupies successive storage locations. In the PDP-11, the main distinction between a list and a stack is that a stack is automatically maintained by the processor and a list is not.
*literal	Used in programming to indicate that the value in the program is the actual value to be used by the computer. Opposite of "symbolic."
load	To place data into storage.
location	A place in storage or memory where a unit of data or an instruction can be stored.
loop	A sequence of instructions that is executed repeatedly until a termination condition exists.

*branch	A point in a routine where one of two or more choices is made under control of the routine. The PDP-11 has many branch instructions and one unconditional branch instruction.
breakpoint	A location at which execution of a program is stopped to allow operator investigation. A debugging routine inserts a breakpoint to control the running of the program being tested and to return control to the debugging routine after execution of the test program segment.
buffer	A storage device used to compensate for a difference in rate of data flow or time of event occurrence when transmitting data from one device to another.
buffer register	See "buffer."
*bus	See "Unibus."
*bus address	The current address on the bus: may be the address of a device, the processor, or a memory location.
*bus address register	A processor register that holds the address from the processor for display and then loads it onto the Unibus at the required time.
*bus device	Any external device, including core memory, that is connected to the Unibus and has an assigned device address and/or priority level.
*bus driver	A circuit or module used to pass signals to the Unibus in accordance with the transmission line characteristics of the bus.
*bus master	The bus device that has control of the Unibus.
*bus receiver	A circuit or module used to receive signals from the Unibus. These circuits use gates with high input impedance and proper logic thresholds to ensure that the received signal is compatible with the rest of the system.
*bus request	A request from a peripheral for control of the bus in order to become bus master and initiate an interrupt or perform a data transfer.
*bus slave	The peripheral that is communicating with the bus master.
*bus transceiver	A module containing both bus driver and bus receiver circuits.
*bus transmitter	See "bus driver."
byte	A group of binary digits usually operated upon as a unit; half of a word; in the PDP-11, bytes are eight bits long. See also, "high-order byte" and "low-order byte."
C	
call	To transfer control to a specified routine.
calling sequence	A specified set of instructions and necessary data required to call a given routine.
carry	In performing binary addition, one bit of information often has to be carried from one digit of the addition to the next most significant digit. This operation is referred to as a "carry."
*carry bit	Indicates that an operation resulted in a carry from the most significant bit. During subtraction, indicates a borrow from bit 16.
central processor	See "processor."
channel	A path, along which, signals can be transmitted; for example, data channel or output channel. Also refers to a more general path composed of a number of components, for example, communications channel.
character	A single letter, numeral, or symbol that is used to represent information.

	turn is interrupted by another subroutine, etc. The processor keeps track of the data so that as each subroutine is completed, the next one is continued. Also refers to calling a subroutine from a subroutine.
*non-processor	Refers to data transfers between any two peripheral devices, including memory, without supervision of the processor. The two devices use the Unibus during data transfers which are accomplished between Unibus cycles.
O	
object program	The binary-coded program which is the output after translation from the source language; the binary program that runs on the computer.
octal	A number system with a radix of 8 which is used as a shorthand notation of a binary number.
offline	Pertaining to equipment or devices not under direct control of the computer.
*offset	A two-digit octal number in an instruction that is multiplied by two and added to the program counter to indicate the location of the next instruction. The offset is normally used only in branch instructions.
one's complement	The binary number obtained by complementing all bits of another binary number. Used as the first step in complement arithmetic so that binary subtraction can be performed by using addition techniques. The second step is to increment the one's complement which then provides the two's complement number.
online	Pertaining to equipment or devices under direct control of the computer; also pertains to programs operating directly and immediately to user commands.
operand	That portion of an instruction code which is affected, manipulated, or operated upon.
operator	That which indicates the action to be performed on the operand.
OR gate	A circuit with multiple inputs that provides the desired output when a signal representing assertion is present at any input.
origin	The absolute address of the beginning of a program or of a unique area of code or data.
output	Information transferred from the internal storage of a computer to output devices or external storage.
overflow	Generation of a quantity beyond the capacity of the arithmetic or storage facility.
P	
parity	A method for checking the correctness of binary characters. An extra bit (called parity bit or PB) is added to numbers in systems using parity. If even parity is used, the sum of all 1's in a number including the parity bit is even; if odd parity is used, the sum is odd.
*passive release	Pertains to the Unibus. Indicates that the bus master releases the bus by dropping the bus busy signal. See "active release."
peripheral	Any unit of equipment, outside of the processor or Unibus, that provides the system with outside communication, storage, and/or service. Also called "external device" or "I/O device."
*pointer	A core memory location containing the actual (effective) address of the desired data; in the PDP-11, pointer often refers to the register containing the pointer address. See "stack pointer."
*pointer address	See "pointer."

debug	To detect, locate, and remove mistakes from a program or malfunctions from a computer.
debugging program	An independent, self-contained service program which allows the programmer to communicate with the object program in order to make modifications, additions, and deletions.
decoder	A logic device capable of converting from one numbering system to another (such as an octal-to-decimal decoder) or designed to interrogate certain bits from an input word to supply specific information such as an address or operation code.
DECtape	A DEC development of convenient, pocket-size reels of digital magnetic tape; sometimes used to indicate the magnetic tape recording peripheral produced by DEC.
*dedicated controller	A processor or computer system, usually with a read-only memory, that is designed and/or used to control only one specific process. For example, a computer designed to continually monitor, evaluate, and change a chemical process.
*dedicated line	A signal path used for only one purpose.
deferred address	Indirectly addressed. The contents of the location is the address of the operand rather than the operand itself.
delimiter	A character that separates and organizes elements of data.
*destination major state	A PDP-11 major state that retrieves destination data from internal or external storage. All necessary address calculations for obtaining the destination data are performed at this time.
*device	Usually refers to an external device which is synonymous with the term "peripheral."
*device flag	A bit in either the interface logic or the device itself that is set to indicate a specific condition such as ready or busy.
*device selection code	Part of an address that is used to specify that a particular device has been selected for use.
*device-to-device transfer	Transfer of data without supervision of the processor. Data is passed directly from one device to another through the Unibus.
diagnostic	Pertaining to the detection and isolation of a malfunction or mistake; usually used in the form "diagnostic programming."
digit	A character used to represent one of the non-negative integers smaller than the radix. For example, in binary notation (radix 2), a digit is either 1 or 0.
digital-to-analog converter	A peripheral device that receives a digital value and transforms it to and equivalent analog signal.
*direct address	An address that specifies the location of an instruction operand.
*direct address mode	Any PDP-11 address mode that is not deferred.
*direct memory access	Transfer of data into memory without supervision of the processor. Data is passed directly between the core memory and another device through the Unibus. Transfers are usually accomplished with a non-processor request.
disable	To render inoperative or to prevent from being used. Normally used with reference to hardware as opposed to "inhibit" which normally refers to signals.
disk	A mass-storage device. Basic unit is a disk on which data is magnetically recorded. Data can be accessed randomly, and access time is faster than with magnetic tape

random access	Unordered access, usually used to describe unordered access to data or a device.
read	To transfer information from an input device to internal storage; also refers to the internal acquisition of data from core memory or other external memories.
*read-only memory	A random access memory that contains components which permanently assume a specific state so that data can be read from memory but cannot be erased, changed, or added.
real time	Any data manipulation, calculation, or control operation that is performed during the monitored task rather than after completion. For example, a satellite control system is a real time system as opposed to a system that analyzes data some period of time after all of the data has been recorded.
*receiver	See "bus receiver."
*recursive	A code or program that permits a subroutine to be called and then, if desired, call itself during operation; a closed subroutine that calls itself.
*reentrant	Pure code which can be interrupted and started again without error. The interrupt service may use the interrupt routine. Upon completion of the interrupt, the routine continues from the interrupt point.
register	A device capable of storing a specified amount of data, such as one word; usually refers to a flip-flop storage device or core memory location.
*register mode	A PDP-11 address mode in which the operand is contained in one of the eight general-purpose registers.
relative address	The number that specifies the difference between the absolute address and the base address. Also, the address formed by the sum of the base and the displacement.
*relative mode	A PDP-11 address mode that specifies the operand address relative to the program counter to permit relocatable addresses. This mode is a combination of the index mode used in conjunction with the program counter.
relocate	To move a routine from one portion of storage to another and to adjust the necessary address references so that the routine can be correctly executed at its new location.
relocatable	See "relocate."
remote access	Communication with a computer by one or more stations that are distant from the computing facility.
*reserved instruction	Instructions that have an op code which has no defined function in systems using the processor. If any of these instructions are used, a trap occurs.
response time	The time which elapses between generation of an inquiry at a device and receipt of a response at the device.
restore	To return to its original condition. Normally refers to a memory restore cycle. Since the contents of a memory location are destroyed when read, they must be restored after each read cycle. This is accomplished automatically.
routine	A set of instructions, arranged in the proper sequence, needed to cause the computer to perform a desired task.
run	A single, continuous execution of a program.

S

scratch pad memory	Any memory used for temporary storage. Usually refers to internal storage registers that hold partial results or operands until needed to complete a calculation.

file	A collection of related records treated as a unit.
fixed point	The position of the radix point in a number system is constant according to a predetermined convention.
flag	A character that signals the occurrence of some condition, such as the end of a word.
flip-flop	A basic computer circuit or device capable of assuming one and only one of two stable states.
floating point	A number system in which the position of the radix point is indicated by one part (the exponent) and another part represents the most significant digits (the fraction).
flowchart	A graphical representation of the sequence of instructions required to carry out a data processing operation.
foreground processing	The automatic execution of high priority programs that have been designed to preempt the use of the computing facilities.
format	The arrangement of data.
G	
*general register	One of eight 16-bit internal registers in the PDP-11 processor. These are used for temporary storage, as accumulators, as index registers, as stack pointers, and other general-purpose functions.
H	
hard copy	Information stored on a permanent medium that is readable, such as a printout from a line printer or teletype printer.
hardware	Physical equipment such as mechanical, electrical, or electronic devices.
head	A component that reads, records, or erases data on a storage device. Often referred to as a recording head or magnetic head.
*high-order byte	The most significant byte in a word; in the PDP-11, indicates the byte occupying bit positions 8 through 15 of a word. The high-order byte is always an odd address.
I	
*immediate address	An address mode that includes the operand as part of the instruction. The operand is the word immediately following the first word in a two- or three-word instruction in the program. This mode is actually the autoincrement mode used in conjunction with the program counter.
*index	An address mode that uses data in a general register as a base for address calculations to permit random access to items in tables or stacks of data.
indirect address	An address in a computer instruction that indicates a location where the address of the referenced operand is to be found. See "deferred."
inhibit	To prevent. Normally used with signals rather than hardware to indicate that the signal is prevented from occurring. Also used with memory. For example, the inhibit signal prevents the core from changing state.
initialize	To set counters, switches, and addresses to zero or other starting values at the beginning of, or at prescribed points in, a computer program.
input	The transferring of data from auxiliary or external storage into the internal storage of the computer.
*instruction register	An internal register in the KA11 processor that stores the instruction fetched from memory so that portions can be decoded as needed during subsequent time states.

switch register	An 18-bit register composed of manually operated switches that are used to load either addresses or data into the PDP-11 system. The switch register is on the front of the processor console.
symbolic address	A set of characters used to specify a memory location within a program.
symbolic coding	Writing instructions using mnemonic notation instead of actual machine language (binary) notation.
symbolic language programming	Writing program instructions in a language which facilitates the translation of programs into binary code by making use of mnemonic conventions.
symbolic program	A service program that translates symbolic programs into binary-coded programs. The programmer writes the symbolic program using symbols which are meaningful to him and the symbolic program translates the symbols into binary code which is meaningful to the computer.
synchronize	To ensure that a level or pulse is presented to a system or component at the correct time.
synchronous	All changes occurring simultaneously or in a definite, timed sequence.
*system unit	A mounting unit composed of three 8-slot connector blocks used to mount logic modules. System units are the basic building blocks of the PDP-11 system.
T	
*T bit	A bit in the processor status word used in program debugging. This bit can be set or cleared under program control. If set, a processor trap occurs upon completion of the instruction.
table	A collection of data in which each item is uniquely identified by its position relative to the other items, or by some other means.
tag	One or more characters attached to an item or record for the purpose of identification.
terminal	A device in a system through which data can either enter or leave.
*time out	A specified amount of time (10 microseconds) that the system waits for a response from a referenced address. If there is no response within the specified time, an error occurs. Time-out errors are caused, in general, by attempts to reference nonexistent memory or nonexistent peripherals or words at odd addresses.
time sharing	A method of allocating processor time and other computer services among multiple users so that the computer, in appearance, processes a number of programs simultaneously.
toggle	To use console switches for entering data into the computer internal storage or memory; to cause alternation of states as in toggling a flip-flop.
track address	The part of a mass storage device which is the beginning of a specific block of data.
trailer	Identical to "leader" except it is at the end, rather than the beginning of a tape.
*transceiver	See "bus transceiver."
translate	To convert from one language to another.
*trap	An unprogrammed jump to a known location, automatically activated by the hardware if certain predetermined conditions occur, such as illegal instructions, errors, etc.
turnkey	A computer console containing only one control, usually a power switch, that can be turned on or off only with a key.

*low-order byte	The least-significant byte in a word; in the PDP-11, indicates the byte occupying bit positions 0 through 7. The low-order byte is always an even address.
M	
machine language	The actual language used by the computer in performing operations; usually refers to either binary or octal codes; also often used to refer to assembler language coding.
machine language programming	Writing a program in binary or octal notation, or converting from a symbolic program to a binary program.
macro instruction	An instruction in a source language that is equivalent to a specified sequence of assembler instructions.
main frame	See "processor."
*major state	A computer timing cycle. In the PDP-11 system, there are five major states: fetch, source, destination, execute, and service. Not all major states are entered for each instruction.
manual input	The entry of data by hand into a device at the time of processing.
manual operation	The processing of data in a system by direct manual techniques.
mask	A pattern of bits that is used to control the retention or elimination of portions of another pattern of bits; a filter.
mass storage device	A bulk storage device, such as a disk.
*master/slave	The relationship between two devices communicating through the Unibus. The controlling device is master, the responding device is the slave.
memory	The storage in the system; pertaining to a device in which data can be retrieved. See also "core memory," "read-only memory," and "wordlet memory."
memory address	Usually refers to the address in external core memory which is being used at the time for reading or writing.
mnemonic symbol	A symbol chosen to assist the human memory; a memory aid. For example, the abbreviation MPY for the word multiply.
most-significant bit	The leftmost bit in a byte or word.
most-significant digit	The leftmost digit of a number.
*mounting box	The cabinet used to house the basic KA11 Processor, core memory, and other logic circuits. The operator's console is attached to the front of the box. Other mounting boxes may be used for additional logic cards or memory and normally have a blank front panel. Sometimes "drawer" is used instead of "mounting box" but the latter is the preferred term.
N	
negate	A process of converting the value of a binary function or variable to the equivalent two's complement number.
nested interrupt servicing	An operation by which servicing of an interrupt for a device can be interrupted in order to service a higher priority device. Upon completion, servicing of the lower priority device is automatically resumed. This operation is not limited to two devices; therefore, an interrupt can be interrupted by another device which in turn is interrupted.
*nesting	Including a routine or block of data within another routine or block of data. In the PDP-11, more specifically refers to interrupting of a routine by a subroutine that in

polling	A centrally controlled method of calling a number of devices to permit them to transmit information; interrogation of peripherals one at a time to determine which peripheral desires service. Not used in the PDP-11 system.
*pop	To remove a word from the top of a pushdown/popup list.
position independent	See "relocatable."
*power fail	Logic circuits that protect an operating program in the event computer primary power fails. The circuits automatically store current operating parameters of the program as well as indicators of a power failure. When power is returned, the processor automatically makes use of this information to continue the program.
predefined process	A named process consisting of one or more operations or program steps that are specified elsewhere in the program.
*priority arbitration	A method used by the processor to compare its own priority with priorities from devices requesting the bus in order to determine which device, if any, is granted control of the Unibus.
*priority interrupt	Refers to the four-level priority interrupt system employed by the PDP-11 system.
*priority transfer	The signal sequence by which a device is selected as next bus master. No actual bus transformer is performed, only selection of the next bus master.
procedure	The course of action taken for the solution of a problem or performance of a specified operation, a portion of an algorithm translated into machine code.
*processor	A unit of a computing system that includes the circuits controlling the interpretation and execution of instructions. The processor does not include the Unibus, core memory, interface, or peripheral devices. The term "main frame" is sometimes used but this term refers to all components (processor, memory, power supply) in the basic mounting box.
*processor status word	An addressable register in the external page indicating the current priority of the processor and the results of the previous operation as indicated by the condition code bits.
program	The complete sequence of instructions and routines necessary to solve a problem or perform a specified action.
*program counter	A general-purpose register (number 7) that contains the address of the next word to be fetched.
program library	A collection of available computer programs and routines in a specific format.
propagation delay	The time required to transfer information from the input to the output of an electronic device.
pulse	A voltage that goes from one level to another, remains there for a short time, and then returns to the original level.
pulse width	The length of time a pulse voltage is at the second, or transient level.
punched paper tape	A paper tape containing a pattern of holes used to represent data; a tape used to feed in or receive information from a computer system.
*push	To place a word on the top of a pushdown/popup list.
*pushdown list	A list that is constructed and maintained on a "last in, first out" basis.

R

radix	The base of a number system; i.e., the quantity of characters that can be used in each digital position of the number system.

BSP	back space
BSR	bus shift register back space record
BSY	busy
BVC	branch if overflow clear
BVS	branch if overflow set
CBR	console bus request
CLC	clear carry
CLK	clock
CLN	clear negative
CLR	clear
CLV	clear overflow
CLZ	clear zero
CMP	compare
CNPR	console non-processor request
CNTL	control
COM	complement
COND	condition
CONS	console
CONT	contents continue
CP	central processor
CSR	control and status register
D	data
D/A	digital-to-analog
DAR	device address register
DATI	data in
DATIP	data in. pause
DATO	data out
DATOB	data out. byte
DBR	data buffer register
DCDR	decoder

*service	In the PDP-11, refers to a major state during which extra operations are performed; in general, refers to servicing an external device that desires to communicate with the computer.
service routine	A program used for general support of the user. For example, I/O routines, diagnostics, and other utility routines.
shift register	A register in which all information stored in the register is shifted one bit position to the right or left according to a specified instruction or action.
sign bit	When using complementary arithmetic, the bit directly to the left of the number indicates the sign (+ or -) of the number. A 1 indicates negative numbers, an 0 indicates positive numbers.
*single-operand	PDP-11 instructions that contain only one address field, that of the destination operand.
software	The collection of programs, procedures, rules, and related documentation associated with operation of a specific computer. For example, compilers, editors, utility programs, and related documentation and run procedures.
*source address	The address of the first operand in a two-address instruction (double-operand instruction).
source language	A symbolic language that is an input to a given translation process.
*source major state	A PDP-11 major state that retrieves source data from internal or external storage. All necessary address calculations for obtaining the source data are performed at this time.
*stack	A dynamic, sequential list of data with special provision for access from one end. Storage and retrieval from stacks is called "pushing" and "popping" respectively. In the PDP-11, the stack is automatically maintained by the hardware.
*stack overflow	A condition that indicates a push onto the processor stack below absolute address 400.
*stack pointer	The element used to indicate the top item on a stack. In the PDP-11, general register 6 serves as a stack pointer. The contents of this register is the address of the first (bottom) word on the hardware stack.
statement	A meaningful expression or generalized instruction in a source language.
*status register	A 16-bit register in which the high-order byte is unused and the low-order byte stores the processor status word; a register storing the external device status word.
*status word	See "processor status word."
step	One operation in a routine.
store	To enter data into a device where it can be held and can be retrieved.
string	A connected sequence of entities such as characters in a command string.
subroutine	A small routine, usually performing only one task, that is called frequently from various points of the main routine.
subroutine, closed	A subroutine not stored in the main part of a program. Such a subroutine is entered by a jump or branch operation, and provision is made at the end of the subroutine to return control to the calling program.
subroutine, open	A subroutine that must be inserted into a program at each place it is to be used.

List 1 – Abbreviations (Cont)

IR	instruction register
IRD	instruction register decoder
ISR	instruction shift register
JMP	jump
JSR	jump to subroutine
LIFO	last in, first out
LKS	line time clock status register
LOC	location
LP	line printer
LSB	least-significant bit
LSBY	least-significant byte
LSD	least-significant digit
LTC	line time clock
MA	memory address
MAR	memory address register
MBR	memory buffer register
MEM	memory
ML	memory location
MOV	move
MSB	most-significant bit
MSBY	most-significant byte
MSD	most-significant digit
MSEL	memory select
MSYN	master sync
ND	negative driver
NEG	negative
NOR	normalize
NPG	non-processor grant
NPR	non-processor request
NPRF	non-processor request flag
NS	negative switch
ODT	octal debugging technique
OP	operate operation
OPR	operator operand
PA	parity available
PAL	program assembly language
PB	parity bit
PC	program counter

U

*Unibus	The single, high-speed bus structure shared by the KA11 Processor, core memory, and all peripherals.
*unidirectional	Capable of traveling in only one direction. Refers to the Unibus control transfer lines that carry signals to select the next bus master.
unit load	All inputs impose a load on the outputs driving them. A TTL unit load requires 1.6 ma at ground and +40 ua at + 3 volts. The load imposed upon an output by an input can be defined as a number of unit loads.

V

*vector	Two words, containing the value of the program counter and processor status word, respectively, that direct the processor to a new routine.
*vector address	The address of the location containing the vector words.

W

*wait loop	A condition caused by the program WAIT instruction to allow the processor to wait for an interrupt. When the processor is in a wait loop, it does not compete for bus control by fetching instructions or operands from memory.
*word	A 16-bit unit of data in the PDP-11 that is stored in two successive locations. The word address is always an even address.
*word boundary	The division between even numbered addresses. Since each word occupies two storage locations, words can be addressed only on even boundaries; bytes can be addressed on either even or odd boundaries.
word count	The number of words in the block of data to be transferred.
word length	The number of bits in a word.
*wordlet memory	A small read/write memory used with the read-only memory. The wordlet memory (MW11-A) is used primarily for temporary data and instruction storage.
write	To transfer information from internal storage to an output device or external storage.

SP	stack pointer spare
SR	switch register
SRC	source
SSYN	slave sync
ST	start
STPM	set trap marker
STR	strobe
SUB	subtract
SVC	service
SWAB	swap byte
TA	trap address track address
TEMP	temporary
TDR	timing, driver
TK	teletype keyboard
TKB	teletype keyboard buffer register
TKS	teletype keyboard status register
TP	teletype printer
TPB	teletype printer buffer
TPS	teletype printer status register
TRT	trace trap
TSC	timing state control
TSS	timing, selection switch
TST	test
UTR	user trap
VEC	vector
WC	word count
WCR	word count register
XDR	X-line driver
XRCG	X-line read control group
XWCG	X-line write control group
YDR	Y-line driver
YRCG	Y-line read control group
YWCG	Y-line write control group

PDP-11 STANDARD ABBREVIATIONS

List 2 – Definitions (Cont)

clear overflow	CLV
clear zero	CLZ
clock	CLK
compare	CMP
complement	COM
condition	COND
console	CONS
console bus request	CBR
console non-processor request	CNPR
contents	CONT
continue	CONT
control	CNTL
control and status register	CSR
data	D
data buffer register	DBR
data in	DATI
data in, pause	DATIP
dato out	DATO
data out, byte	DATOB
decoder	DCDR
decrement	DEC
delay	DEL
deposit	DEP
deposit flag	DEPF
destination	DST
destination effective address	DE
device address register	DAR
device select	DSEL
Digital Equipment Corporation	DEC
digital-to-analog	D/A
direct memory access	DMA
display X-deflection register	DSX
divide	DIV
emulator trap	EMT
enable	ENB
end-of-file	EOF
end-of-medium	EOM
error	ERR
examine	EXAM
examine flag	EXAMF
execute	EXEC

PDP-11 STANDARD ABBREVIATIONS

List 1 – Abbreviations

ABS	absolute
A/D	analog-to-digital
ADC	add carry
ADRS	address
ASCII	American Standard Code for Information Interchange
ASL	airthmetic shift left
ASR	arithmetic shift right automatic send/receive
B	byte
BAR	bus address register
BBSY	bus busy
BCC	branch if carry clear
BCS	branch if carry set
BEQ	branch if equal
BG	bus grant
BGE	branch if greater or equal
BGT	branch if greater than
BHI	branch if higher
BHIS	branch if higher or same
BIC	bit clear
BIS	bit set
BIT	bit test
BLE	branch if less or equal
BLOS	branch if lower or same
BLT	branch if less than
BMI	branch if minus
BNE	branch if not equal
BPL	branch if plus
BR	branch, bus request
BRD	bus register data

List 2 – Definitions (Cont)

extended arithmetic element	EAE
external	EX
external reset	EXR
first in, last out	FILO
flag (when used alone)	FLG
flag (when used with signal name)	F
function	FCTN
generator	GEN
increase	INC
increment	INC
increment flag	INCF
indicator	IND
inhibit	INH
initialize	INIT
input/output	I/O
input/output executive routine	IOX
input/output trap	IOT
instruction	INST
instruction register	IR
instruction register decoder	IRD
instruction shift register	ISR
integer divide routine	IDIVR
interrupt	INTR
interrupt flag	INTRF
jump	JMP
jump to subroutine	JSR
last in, first out	LIFO
least-significant bit	LSB
least-significant byte	LSBY
least-significant digit	LSD
line printer	LP
line time clock	LTC
line time clock status register	LKS
location	LOC
master sync	MSYN
memory	MEM
memory address	MA
memory address register	MAR
memory buffer register	MBR

DE	destination effective address
DEC	decrement Digital Equipment Corporation
DEL	delay
DEP	deposit
DEPF	deposit flag
DIV	divide
DMA	direct memory access
DSEL	device select
DST	destination
DSX	display, X-deflection register
EAE	extended arithmetic element
EMT	emulator trap
ENB	enable
EOF	end-of-file
EOM	end-of-medium
ERR	error
EX	external
EXAM	examine
EXAMF	examine flag
EXEC	execute
EXR	external reset
F	flat (part of signal name)
FCTN	function
FILO	first in, last out
FLG	flag
GEN	generator
IDIVR	integer divide routine
INC	increment increase
INCF	increment flag
IND	indicator
INH	inhibit
INIT	initialize
INST	instruction
INTR	interrupt
INTRF	interrupt flag
I/O	input/output
IOT	input/output trap
IOX	input/output executive routine

List 2 – Definitions (Cont)

subtract	SUB
subtract carry	SBC
swap byte	SWAB
switch register	SR
teleprinter status register	TPS
teletype keyboard	TK
teletype keyboard buffer register	TKB
teletype keyboard status register	TKS
teletype printer	TP
teletype printer buffer	TPB
temporary	TEMP
test	TST
timing, driver	TDR
timing, selection switch	TSS
timing state control	TSC
trace trap	TRT
track address	TA
trap address	TA
user trap	UTR
vector	VEC
word count	WC
word count register	WCR
X-line driver	XDR
X-line read control group	XRCG
X-line write control group	XWCG
Y-line driver	YDR
Y-line read control group	YRCG
Y-line write control group	YWCG

PD	positive driver
PDP	programmed data processor
PERIF	peripheral
PGM	program
PP	paper tape punch
PPB	paper tape punch buffer register
PPS	paper tape punch status register
PR	paper tape reader
PRB	paper tape reader buffer register
PROC	processor
PRS	paper tape reader status register
PS	processor status positive switch
PTR	priority transfer
PTS	paper tape software system
PUN	punch
RD	read
RDR	reader
REG	register
REL	release
RES	reset
ROL	rotate left
ROM	read-only memory
ROR	rotate right
R/S	rotate/shift
RTI	return from interrupt
RTS	return from subroutine
R/W	read/write
R/WSR	read/write shift register
S	single
SACK	selection acknowledge
SBC	subtract carry
SC	single cycle
SE	source effective address
SEC	set carry
SEL	select
SEN	set negative
SEV	set overflow
SEX	sign extend
SEZ	set zero
SI	single instruction

List 3 – ASCII CODE (Cont)

FF	form feed
FS	file separator
GS	group separator
LF	line feed
NAK	negative acknowledge
NUL	null
RS	record separator
SI	shift in
SO	shift out
SOH	start of header
STX	start of text
SUB	substitute
SYN	synchronous idle
TAB	tab
US	unit separator
VT	vertical tab

List 2 – Definitions

absolute	ABS
add carry	ADC
address	ADRS
American Standard Code for Information Interchange	ASCII
analog-to-digital	A/D
arithmetic shift left	ASL
arithmetic shift right	ASR
automatic send/receive	ASR
back space	BSP
back space record	BSR
bit clear	BIC
bit set	BIS
bit test	BIT
branch	BR
branch if carry clear	BCC
branch if carry set	BCS
branch if equal	BEQ
branch if greater or equal	BGE
branch if greater than	BGT
branch if higher	BHI
branch if higher than or same	BHIS
branch if less or equal	BLE
branch if less than	BLT
branch if lower or same	BLOS
branch if minus	BMI
branch if not equal	BNE
branch if overflow clear	BVC
branch if overflow set	BVS
branch if plus	BPL
bus address register	BAR
bus busy	BBSY
bus grant	BG
bus register data	BRD
bus request	BR
bus shift register	BSR
busy	BSY
byte	B
central processor	CP
clear	CLR
clear carry	CLC
clear negative	CLN

List 2 – Definitions (Cont)

memory location	ML
memory select	MSEL
most-significant bit	MSB
most-significant byte	MSBY
most-significant digit	MSD
move	MOV
negate	NEG
negative driver	ND
negative switch	NS
non-processor grant	NPG
non-processor request	NPR
non-processor request flag	NPRF
normalize	NOR
octal debugging technique	ODT
operand	OPR
operate	OP
operation	OP
operator	OPR
paper tape punch	PP
paper tape punch buffer register	PPB
paper tape punch status register	PPS
paper tape reader	PR
paper tape reader buffer register	PRB
paper tape reader status-register	PRS
paper tape software system	PTS
parity available	PA
parity bit	PB
peripheral	PERIF
positive driver	PD
positive switch	PS
priority transfer	PTR
processor	PROC
processor status	PS
program	PGM
program assembly language	PAL
program counter	PC
programmed data processor	PDP
punch	PUN
read	RD
reader	RDR

Aquatic Organisms

Microorganisms

No information was found in the available literature.

Plants

No information was found in the available literature.

Invertebrates

No information was found in the available literature.

Vertebrates

No information was found in the available literature.

Non-Aquatic Organisms

Microorganisms

No information was found in the available literature.

Plants

No information was found in the available literature.

Invertebrates

No information was found in the available literature.

Vertebrates

No information was found in the available literature.

List 2 – Definitions (Cont)

read-only memory	ROM
read/write	R/W
read/write shift register	R/WSR
register	REG
release	REL
reset	RES
return from interrupt	RTI
return from subroutine	RTS
rotate left	ROL
rotate right	ROR
rotate/shift	R/S
selection acknowledge	SACK
select	SEL
service	SVC
set carry	SEC
set negative	SEN
set overflow	SEV
set trap marker	STPM
set zero	SEZ
sign extend	SEX
single	S
single cycle	SC
single instruction	SI
slave sync	SSYN
source	SRC
source effective address	SE
spare	SP
stack pointer	SP
start	ST
strobe	STR

Vertebrates

No information was found in the available literature.

Transport Paths and Rates

No information was found in the available literature.

Estimated Current Distribution in the Environment

Industrial Effluents

Diphenylhydrazine is currently being discharged by numerous industrial point sources; thus, current discharges are widely distributed. No information was available on diphenylhydrazine concentrations in effluent discharges from production or end-use manufacturing processes. Data needs to be collected from these sources to enable the assessment of the environmental and geographic distribution of diphenylhydrazine.

Municipal Effluents

It was not possible to assess the distribution of diphenylhydrazine in municipal effluents due to lack of data. Considering the unstable nature of the compound, appreciable levels are not expected to be found in municipal effluents.

Natural Waters

An assessment of the distribution of diphenylhydrazine in natural waters was not possible due to the lack of information. Considering the instability of the compound, appreciable levels are not expected to be found in natural waters.

List 3 – ASCII CODE

ACK	acknowledge
ATL	alternate (mode)
BEL	bell
BS	back space
CAN	cancel
CR	carriage return
DC1	device control 1
DC2	device control 2
DC3	device control 3
DC4	device control 4
DLE	data link escape
EM	end-of-medium
ENQ	enquiry
EOT	end-of-transmission
ESC	escape
ETB	end-of-transmission block
ETX	end-of-test

Estimated Current Effects on Populations

Microorganisms

No information was found in the available literature.

Plants

No information was found in the available literature.

Invertebrates - Aquatic

No information was found in the available literature.

Vertebrates - Aquatic

No information was found in the available literature.

Vertebrates - Non-Aquatic, Birds

No information was found in the available literature.

Vertebrates - Non-Aquatic, Mammals

Non-Human

Injection of 1,1-diphenylhydrazine hydrochloride into a dog resulted in reduced hemoglobin levels by 22 percent in 2 weeks (1). The injection of 1,2-diphenylhydrazine into rabbits produced a mild anemia (1). 1,2-Diphenylhydrazine was mildly carcinogenic towards laboratory animals but only after long periods of exposure (2-5).

CHAPTER VI
ENVIRONMENTAL FATE AND EFFECTS
DIPHENYLHYDRAZINE

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